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MILK

By
E. F. BRUSH, M.D.

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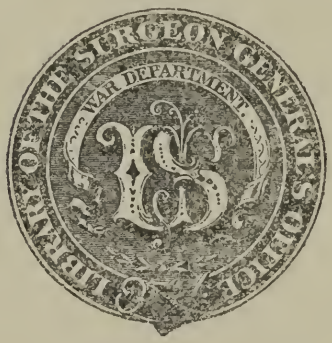

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MILK

By E. F. Brush, M. D.

Physician, Veterinarian and Dairyman.

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PREFACE.

This volume is simply a collection of essays contributed to the various medical societies and journals during the past seventeen years. It would be vain for the author to claim that there was no other motive than that of love for scientific truth impelling the work. However, as a physician and veterinarian, it cannot be judged dishonest for him to say that there has been a sincere desire to reach the truth and follow it. And, on the other hand, as a dairyman trying to produce the best milk that is within human possibility, there has been, of course, more or less trade interest. Therefore, if these two designs can be allowed without prejudice on the part of the reader, there is hope that the work will benefit others as well as the author.

Mount Vernon, N. Y., April, 1898.

MILK.*

The position that milk occupies in scientific works at the present day is very unsatisfactory to the medical practitioner. Almost every author gives a different analysis, and many of the phenomena still remain unexplained. The lactometer which has been merely a source of dispute in the past is now abandoned. The majority of works on milk analysis lack precision in details, because they mostly leave out albumen as a constituent of milk and mass together all the milk salts as sugar. This, of course, is very unsatisfactory and misleading, for it is a fact regarding these substances, that on the proportion existing between them and the caseine the quality of the milk depends. I have previously stated in the *New York Medical Journal* the fact that, as caseine decreases, the milk, sugar and the albumen increase, and *vice versa*. By ascertaining these we can determine the wholesomeness of any given specimen of milk.

*An essay read before the Medical Society of the County of Westchester at the Annual Meeting, held at White Plains, Tuesday, June 21, 1881.

But, in examining milk, we must consider another point, that is the position it occupies as a producer and distributor of disease. Compared with this acknowledged fact, simple dilution with water is of slight importance. Diseases may be conveyed by milk taken from an animal suffering from disease, or by milk contaminated in the dairy, or by contact with diseased or infected persons. There is no definite law forbidding the sale of milk from diseased animals. On reading the last Report of the Department of Agriculture, I find a statement made by a dairyman on Long Island, in which he declares to the commissioners that for twenty years he has had cases of pleuro-pneumonia in his herd. In this disease the flow of milk is not usually entirely suspended, and it is only lessened slightly during the first few days of active fever. When the flow is suspended, it is during the extreme heat of summer, when the disease attains its utmost violence — that is, when the animal is about to die. There can be no doubt that the milk of a cow suffering from a disease of this character must be poisonous. On analysis of milk thus diseased, I have discovered an increased amount of albumen as the only difference. Garget, an inflammatory condition of the internal substance of the udder, is another vaccine disease which causes unwholesomeness

in milk. In cases of foot-and-mouth disease — a disease producing in the cow aphtha, diarrhoea and enlarged glands — Dr. Joseph Weil writes that the "raw milk produces a feverishness, swelling of the tonsils and submaxillary glands and pemphigenous eruptions on the lips and tongue." I need not, even if time permitted, enumerate all the other diseases which infect milk. But this dissemination of disease by diseased milk is a fact which we medical men ought to recognize. We ought to bestir ourselves to procure legislation defining the duties of milk-producers as regards the health of their animals. At present the whole law seems to have been made for the pecuniary protection of corporations and herdsmen. In fact, half of the laws are enacted to protect butter and cheese factories from skim-milk and oleomargarine. It is significant that the first law passed in this State respecting milk was passed, not to prevent the Orange County Association from selling diseased milk, or for protecting the thousands of children whose food it supplies, but to prevent their agents from defrauding them. The whole tenor of the law is in the same direction. There is indeed a law saying unhealthy milk must not be sold, but the definition of "unhealthy," as given in the law, is "milk from cattle feeding on

distillery swill, or on any substance in a state of putrefaction." The factories are further protected by the prohibition of the sale of tainted milk, or milk kept in dirty vessels. They are also protected by a law prohibiting the sale of skim-milk. This insane law is the only definite one, except the one against the addition of water. We all know that if the same energy had been directed by the New York Board of Health against diseased milk, which has been directed against watered milk, the lives of thousands of children would have been saved. From what I have seen of the dairies in Westchester county, and from what I have learned by conversations with dairymen, I am convinced that the greatest cause of disease among infants in New York city actually arises from the use of diseased milk, and the mixture of colostrum with sound milk. This is a most serious and important subject, and utterly neglected by the law. Calves taken immediately from their mothers, "bob-veal," is denounced because it produces disease in his majesty the adult citizen. But no law prohibits the wholesale administration of colostrum to the luckless infant. In none of the numerous works that I have consulted, either scientific or intended for farmers, have I found any allusion to this evil. Thus, even the conscientious man has

no warning and no guide. Many of the milkmen informed me that the third milking after calving was considered fit to mix with other milk. In the course of conversation I casually inquired what effect the third milking would have on a calf three months old. The farmer innocently replied, "It would probably give him the scours." This disease in the calf corresponds to cholera infantum. Last summer I attended a child suffering from cholera infantum. I proposed to give it whey, and to procure it I took some of the milk on which the child had been fed, and attempted to coagulate it with rennet. I failed utterly. I threw the specimen away and sent to the same place for some more milk. The same result ensued. I then left out the rennet and boiled the milk. It coagulated on boiling. As this is what takes place in colostrum, the cause of the attack was plain. By changing the diet the child recovered. This would be an easy test if it were not for the fact that the colostrum is mixed in most cases with a large proportion of milk, and hence only negative results would be attained. In regard to the time when milk is fit to use after calving, I am undecided, as I am still engaged in the investigation. If I succeed in interesting medical men to procure legislation on this subject, I shall be able to give definite

and scientific rules. I will say here that, according to Lehman, colostrum corpuscles remain till the third or fourth day, and occasionally to the twentieth day, and as a general rule returns when any disease supervenes after delivery, or in case the mother is attacked by any acute affection. Colostrum becomes acid more rapidly than milk, and contains less sugar. Let me beg of you not to forget this matter; we owe it to the community to protect their children. I would even go so far as to desire that every dealer in milk be compelled to take out a license, and that in every death-certificate of an infant the name of the milkman supplying it with milk be inserted. The officials of the Board of Health would thus be able to see if the same name occurred repeatedly, and to take steps to stop his sale of poisonous milk. I hope to see the day when the matter will receive due scientific and legislative attention.

There are, of course, other items of great importance relating to the milk of the cow. As we who use the milk belong in the animal kingdom to the non-ruminants, we have to study cows' milk as designed for the stomach of ruminants. If it were possible for us to feed children on the milk of non-ruminant animals, as the human being or ass, there would be much less difficulty

attending the artificial feeding of children. Looking at it in this light, there is no doubt we could mend the matter considerably. Calves always regurgitate and chew the milk before it enters into the digesting stomach. Some people argue that milk, when drawn from the gland and kept, loses at once its vital principle, and thus seek to account for its indigestibility. To my mind this is proved to be false reasoning by the fact that the most successful stock-raisers do not allow the calves to suck. This is not from economy. I can cite a case in point. A farmer with a herd of pedigree stock, in which he took a great pride, allowed his calves to suck. They became so fat as to excite the admiration of all beholders. When the weather became hot they all died. The mode of death was peculiar. They gave a strange cry, which attracted the attention of the farm-hands, reeled round, and, before the men reached them, were dead. One after another they all thus perished. Since then the breeder has fed his calves from a trough with about half the milk from their mothers, and none have died in this manner. These breeders, I need scarcely add, are very particular about the colostrum.

In regard to some of the popular modes of feeding children artificially, I will here explain a few of them. We will first consider boiled milk.

By this procedure we, of course, lower its nutritive value by coagulating the albumen, thus rendering it insoluble. Boiling kills the lactic germs, thus delaying the development of lactic acid, and also deprives milk of whatever vitality it may have. It emphatically benefits milk polluted with colostrum, and probably the coagulation of the caseine in the stomach is less rapid. The addition of lime-water or soda — a favorite method — may be beneficial from the fact that coagulation takes place more slowly and that we are not apt to have the large, leathery coagulum. Last summer, while talking to an eminent practitioner on the subject of feeding infants by artificial means, he stated that one of his children was not doing well with ordinary dilute milk with sugar, and had all the symptoms of defective nutrition. He stopped the milk and gave cream diluted with water. From the very first the child improved and was kept on cream till weaned. In commenting on the case the doctor expressed some surprise, as he considered that cream contained nothing much but fats. In this he was mistaken, as the following analysis will show. I removed eight ounces of cream and carefully avoided any removal of milk with it. From this cream I removed twenty-nine and one-half drachms of butter, one hundred and thirty-nine

and one-half grains of caseine, eighteen grains of soluble albumen by coagulation through heat, and thirty-eight grains of sugar. The analysis proves that in buttermilk we have a wonderfully nutritive fluid. Even after the caseine is removed, the amount of nutrition in the whey of buttermilk is quite large. This fact is enforced by the experience of the Orkney Island fishermen. They precipitate the caseine from buttermilk by boiling water, immediately after churning, and place the whey in small kegs. This they take with them on their voyage, and subsist on it for several days without other food or drink.

ACUTE MILK-POISONING.*

Many of the diseases affecting the digestive organs in infancy are nothing more nor less than milk-poisoning. This is absolutely the cause of *cholera infantum*. I think we should be justified in dropping entirely from our nomenclature the term *cholera infantum*, and calling the disease which has hitherto borne this misleading name by its real term, "acute milk-poisoning." We would thus simplify the treatment by keeping before the practitioner the true cause of the disease, and no other suggestion would be necessary to indicate that the poison ought to be stopped. This is not done now, nor do the text-books point out the absolute necessity of this being done. There is no doubt, too, it will not be done as long as we account for the disease by teething, excessive heat, brain troubles, and so forth. When I tell you, gentlemen, that I have looked to the health and feeding of more than two hundred children this summer, and have not lost one by any acute intestinal disturbance, you may concede to me the right to speak; and when I have given you the facts winnowed from a

* Read before the Westchester County Medical Society, 1885.

year's observations of diseases caused by milk, I cannot but feel you will agree with my conclusions.

Even if we had not facts it seems to me that we could theorize to the same conclusions. Our cows are secreting milk abnormally, and I use the word "secreting" in the sense we understand it physiologically. We keep up the activity of the mammary gland from parturition to parturition, this is, through heat and pregnancy. This process being carried on through generations in the bovine race has resulted in the mammary becoming an excretory gland. When a milking cow eats food which would cause diarrhoea in other animals, she simply gives more milk, and the bowels are seldom much disturbed; but the poison is conveyed to the infant. As on this fact much of my argument is based, and to show that it is no new fact of which I am the solitary observer, I quote the following statement from J. P. Norton, M. A., Professor of Scientific Agriculture at Yale College: "All the effects of poisoning may be produced by the milk without the cows being apparently affected by the pasture." Now the conditions that render milk poisonous are:

1st. *Feeding.*— The sudden change from the dry food of winter to the full flush of grass, pick-

ing up green fruit, eating brewers' grains which make the milk more albuminous and therefore more prone to putrefaction with the increase of summer temperatures, eating poisonous weeds, and drinking poisonous stagnant waters.

2d. *Treatment.*— Dairy farmers endeavor to have their cows calve in spring time when the grass is plentiful, because then the feeding is cheapest and the amount of milk to be got is greater. Now if a cow calves in May she is usually in heat again in forty days, this brings the period to the last of June or the beginning of July. If she were allowed to become pregnant then, her calving time would occur too early next year to get the flush of milk at grass time. Consequently she is allowed to worry and quite often excite the entire herd. This condition affects milk so perniciously that cheesemakers exclude it from the factory; the odor sometimes is perceptibly putrid, and almost always easy to detect when the milk is heated in a water bath. Again, the milk is affected when the cow takes the bull. I have found by observation of my own cows that the milk following the act is always decidedly acid. In the subsequent pregnancy there can be no doubt that the nutritive quality of the milk is lowered. Last, but not least in the treatment of milch cows as a cause of poison-

ous milk, is the cruel abuse to which they are subjected.

3d. *Diseases which space will not at this time permit me to enumerate.*— I will, however, here record my observations on a very common disease in milch cows — common because it occurs frequently and requires little or no treatment, and the milk thus affected finds its way to the market, to convey poison to the children. Last winter I made an experiment on one of my own cows. I bruised one-quarter of the udder, thus producing traumatic garget. This often occurs in pastures by the cow striking the udder against stumps and the like. I found the milk from the gland in the affected quarter for a number of days stringy, lumpy and pus-like, but always alkaline. The milk from the three unaffected quarters presented no abnormal appearance; but, while the traumatic condition existed, was always decidedly acid. When this condition had lasted four days, I gave to one of my own children, aged 16 months, about four ounces of this acid normal-appearing milk. This was five o'clock in the evening. The child fell asleep, but was awakened in two hours, crying, apparently with stomach-ache. She was kept awake till past midnight, and a large quantity of gas was avoided *per rectum*. The next day the bowels

were slightly disturbed. It is easy to imagine if four ounces had this effect, what would be the condition if the child had been fed continuously on such milk.

Returning to the results of treatment, I will cite the following case: One Saturday afternoon, while watching some boys playing ball on the common, I noticed a herd of ten cows feeding in an adjoining lot, attended by the owner, a milkman. Suddenly a cow came running to the herd and mounted the first cow she reached. The owner of the herd picked up some stones and pelted the offending cow, but was unable to drive her away. She continued to mount the cows as they came near her, till finally the entire herd became excited. Then a woman, the owner of the bulling cow, came and attempted to drive her home, but could not do so. Then her boy, a lad of 10, armed with a big stick, came and pounded the cow considerably, but without separating her from the herd. Finally, the old man made his appearance, carrying in his hand a heavy whip. He walked up to the cow, gently holding out his hand as if to feed her, and when close to her laid on the whip quite severely, with the effect of calming her immediately. She trotted for home, he running behind her, giving her a blow every time he came close enough

When she was in the yard, a small enclosure, he beat her for several minutes, and after she was in the stable I could hear an occasional blow. This all occurred before milking time. I was deterred from making an attempt to prevent this cruelty, because of the opportunity thus presented to observe the effect of milk from a cow thus treated, in the feeding of children. This occurred in my own immediate neighborhood, and I knew that if any children were taken sick I would hear of it. As soon after the occurrence as possible I called on my friend, Dr. Campbell, and related the affair to him, asking him to find out who received milk from the cow, as the owners were patients of his. On Sunday evening he was called to see a child, 8 months old, who had been attacked on Saturday night with sharp pains. It had been kept awake all night; it had suffered mild attacks of diarrhoea during the summer, but had never before been disturbed during the night, the attacks always passing away with treatment. This attack, besides keeping the child awake, was accompanied by constant vomiting, which had not characterized any of the previous attacks, and there had been eighteen movements of the bowels in twelve hours, mostly green and undigested milk, an occasional discharge of dirty, mud-colored, watery and offensive material.

The child was very sick, and developed profound symptoms of *cholera infantum*. The doctor inquired on what the baby had been fed, and the answer was, "The bottle, with the milk of one cow." On further inquiry, he learned the milk had been procured from the above-related cruelly abused cow. The child recovered because the poison was stopped, although he was sick for several days.

This accidental observation is not an unusual occurrence; it, or something like it, is happening every day, though we may not be able to follow it up so closely. Take, for instance, the small dairy, with its four or five cows, not sufficient to pay the expense of keeping a bull. The rutting period occurs in the hottest weather; one of the farm hands is directed to drive the cow to the bull, perhaps a distance of two or three miles. Usually he is armed with a big stick, and the cow, especially in this condition, is loth to leave the herd without some emphatic persuasion. She is prodded, attacked, run round the corners, and the ordinary farm-laborer, when he has run fifteen minutes, is apt to get mad. There is no doubt that cases of this kind, if we follow them up, would reveal a like result of acute milk-poisoning.

The following cases of acute milk-poisoning, arising from causes not discovered, are interesting as illustrating this condition:

On a Sunday afternoon a friend of mine called me hurriedly to see his child, a baby 10 months old, and bottle-fed. As he thought it was dying, I obeyed, and was soon at the house. On my arrival I found the child in a profound tonic convulsion. I learned from the parents that I was called in the absence of their regular physician, who had seen the child three hours previous. The sickness had commenced the day before. When this physician had seen the child that day, he inquired on what it was fed, and was told "milk and one of the patent foods." He approved of the diet, and left some medicine. The parents had no idea the child was very sick, so they fed it, and it went to sleep. They went down to dinner, but returning afterward to the room where the baby was, they found it struggling in a convulsion — the convulsion it was in when I came. I immediately wrapped the child in a cold, wet blanket, and endeavored to get a little brandy into its mouth, abstaining from any other treatment, as I knew the attending physician would be in immediately. He came a few minutes after my arrival, when I surrendered the case to him. The father wished me to stay,

and I did so, simply watching the case. When the child was recovering from the convulsion it vomited several large masses of solid caseine, and its bowels were moved several times. When the convulsion had completely subsided I took my departure, but was again called between 6 and 7 in the evening. When I reached the house the child was dead.

On the next day (Monday) I was called to see a child, 9 months old, bottle-fed, who received his milk from the same farm, and had been suffering from a severe diarrhoea since the preceding Friday. I found the child very sick, vomiting and purging. The alvine discharges were mostly green and watery, occasionally mud-colored. I directed that he should receive no milk under any circumstances whatever, but be fed on beef solution and oatmeal-water, and receive every hour a teaspoonful of the following:

R Tr. opii ..... mj.
Tr. ferri ..... mviij.
Aqua ..... ℥j.

The next day I found there had been no abatement in the number of movements of the bowels, but there had been no vomiting. I changed his food to kumyss and he required no further treatment till two weeks later, when I put him on

other food simply for economy. He has continued to do well ever since. Is there any reason why we should not call these cases "milk-poisoning?" One with treatment and a continued use of the milk died; the other, with no treatment to speak of but stopping the milk, made a good recovery. I cite these cases not because they were the only ones observed, but because occurring simultaneously, and getting their poison from the same source, they illustrate the necessity of calling the disease from which they both suffered "acute milk-poisoning."

Usually the beginning of summer complaints in fed babies is at the time when imperfect, worm-eaten green apples are falling; it is continued through the rutting, bulling and conceiving period, to reach its fiercest condition when the pastures are dried by the usual autumn droughts, when the cows eat the poisonous herbs that they had avoided when the grass was green and plentiful.

Some years ago in the Alleghany districts, owing to some poisonous herbage, the cows secreted a milk which was poisonous. As this region was remote from a city market, the natives were compelled to consume their own milk, and were not long in finding that a disease from which they all suffered was caused by the milk.

Its use was quickly stopped and every visitor to the district was advised to abstain from it. They had no statistical tables to consult, and did not therefore find that the sickness increased as the thermometer rose; they had no way of accounting for the disease except from its simple cause, milk, and therefore they called it simply "milk sickness," and invoked the power of the government to suppress it.

[Report from The Archives of Pediatrics, April, 1886.]

INFANT FEEDING.*

Without endeavoring to impress on you any opinions of the necessity of mothers nursing their children, or of the advisability or danger of employing wet-nurses, I shall endeavor in this paper to point out some simple methods of feeding an infant when it is deprived of the breast. I promise you that I will not attempt to be very scientific, because I believe that much harm is occurring from the intensely scientific features of baby feeding to-day. Peptones, indeed, are only second in prominence to bacteria. Probably there is no greater satire on the medical profession at present than the number of patent foods and refuse material offered for infant feeding. It would seem that any one, outside of the profession, can compound a mixture for baby feeding, and through the efforts of the medical profession itself can create a large sale. How many of us know anything certain of the actual composition of the patent foods we are continually recom-

*Read at the Annual Meeting of the Medical Society of New York, 1885.

mending? Certainly great men have tried their skill in compounding a universal infant diet. We all remember the *éclat* with which "Liebig's Food for Infants" was received by a trusting medical world. Although some foods styled "Liebig's" are still advertised, nevertheless "Liebig's food" is out of use; and we ask why? Simply because it was altogether too scientific. It was a chemical compound, not a food. Dr. King Chambers said publicly after a fair trial, "Laputa never devised anything more preposterous than Liebig's Food for Infants." Now let us examine this once famous food, and we shall at the same time understand why some of the more recent chemical compounds are not fulfilling their promise. Liebig's food was composed of milk, wheat-flour, malt, bi-carbonate of potassa, and water. On going over this list of ingredients, *seriatim*, we conclude that the trouble did not come from the milk, unless that was bad to begin with; the wheat flour possibly could create a disturbance, but this is modified in the preparation by the malt, and the malt itself could not possibly be the offending agent. But when we come to the bi-carbonate of potassa we hesitate. It is only recently that we have been so ably warned against the free use of alkalies before this very society. Professor Jacobi in telling us

of the great danger we incur in the use of chlorate of potassa, said also "we are not very careful in the doses of alkalies in general." A new and popular food for infants has lately appeared containing instead of the bi-carbonate of potassa, exactly the same proportions of the bi-carbonate of soda. An ordinary infant needs three pints of food or more daily. Who would think of giving an infant forty-five grains or more of either of the salt of potassa or soda? Professor Alfred Stillé, in a lecture on "Acute Rheumatism," advises the use of bi-carbonate of soda in doses of less than six grains every three or four hours for an adult; and says, regarding it, "The alkaline treatment relieves the pain and saves the heart by *lessening the amount of fibre in the blood*." Now, if doses of less than six grains have this effect on the adult, what shall we expect to be the effect of much larger doses administered to an infant? There is no doubt that with strong alkali the process of nutrition is reversed—that is, the nutritive material is dissolved out of the economy. The so-called peptonized milk, recommended by Dr. Roberts, of England, and made popular in this country by advertising and medical testimonials, is likewise a chemical compound, and I think can be classified as an albuminate of soda. Dr. Roberts, in his very readable

little monograph recommending the food, cites some experiments he made with kittens, two of which he fed on natural milk and two on peptonized milk. Of those fed on the peptonized milk, one shows an absolute loss of twelve grains in two days, while those fed on natural milk showed a steady gain; at the end of ten days these two had gained ninety-five grains, while the two fed on the peptonized milk gained but forty-seven grains. There is very little doubt that if he had examined the blood of the very badly-nourished kittens he would have found it less coagulable than that of the naturally fed felines.

I mention the chemical foods, not because they are the only ones in vogue, but because I regard them as the most dangerous, and I wish to protest against the tendency to take infant feeding into science too deeply, and again using the words of Professor Jacobi, "to give at least one of the million instances in which the individual judgment is biased and medical progress is liable to be thwarted by enthusiasm not complicated with reason."

It does seem to me, gentlemen, that a physician ought to be able, out of the multitude of simple articles within reach, to prepare for the infant a suitable food to meet the requirements of any or every case. One of the greatest ele-

ments of failure in the artificial feeding of infants is the desire to give *one* variety of food under all circumstances. When you fail with a food that you have yourself prepared, then you have, at least, a knowledge as to what your failure arises from. But when you fail with a food, with the composition of which you are not acquainted, then you are lost indeed. It is then with the hope that I can get some appropriate article of diet which you yourselves can teach the mother or nurse to prepare, that I essay to read this paper.

First, we will take the child at birth. After twelve or twenty-four hours, I give the following as the best substitute for colostrum: The white of one fresh egg, two teaspoonfuls of granulated sugar, two teaspoonfuls of sweet oil, a pinch of salt, and one pint of water. Beat together in a saucer, the albumen, sugar, oil, and salt, with a fork as in making a salad-dressing. When they are thoroughly beaten together, drop in slowly from a spoon, meanwhile continuing the beating, five teaspoonfuls of cold water. Then pour the mixture into a pint bottle and shake it well. This mixture should be given from a nursing bottle, warm; it should be warmed carefully, as too much heat coagulates the albumen. The child is fed on this for three or four days; then I begin

adding to each meal a teaspoonful of milk, and increasing the amount of cow's milk until the mixture is half and half. Then I substitute whatever dilutent I decide to be necessary in the case. Now, this is very simple, and washes out the digestive track. If for any reason, the cathartic effect is not decided enough, more sugar can be added, and likewise more oil if necessary. Now, on the other hand, if the cathartic action is too brisk, the addition of cow's milk will lessen the effect.

We are now through with the colostrum period, and are confronted with the question, What is the best staple food? Without hesitation I answer "Cow's milk." I am, however, appalled at the task of telling all the conditions that render it unfit, poisonous, cathartic, constipating, ill-nutritious, too nutritious, and likewise the very best food for the artificial feeding of infants. As long ago as 1879, I made a classification of milks, separating the product of the cud-chewers from that of the non-cud-chewers. As this simple classification enables us to clearly understand some of the difficulties the human young experience in digesting milk designed by nature for bovine young, I will allude to it here but briefly. The milk of all the non-cud-chewers, to which class belong the human, equine,

canine, and others, contains a variety of caseine which is precipitated in fine flakes, thus allowing the digestive juices to attack it more readily. Now, the other class is that of the cud-chewers, which includes the bovine, ovine, and hircine and others. The later all chew the cud soon after birth; therefore, the milk designed for their use contains a variety of caseine which with them coagulates into a mass, sufficiently hard and consistent to be regurgitated and chewed. Therefore, when an infant fed on cow's milk vomits a hard, leathery curd, the indications are that the milk must either be prevented from coagulating, or coagulated and subdivided before entering the stomach. Now, when the rejected matter has a distinctly sour smell, it is undoubtedly due to the souring of the milk, and the amount of any alkali necessary to overcome this tendency would simply be too great. What I am in the habit of giving in these cases is milk with some of the caseine removed and the remainder broken up. This I do with the pepsine mixture, made as follows:

Pepsine (Hawley's), ʒ j;
Acid, hydrochloric, C.P., ʒ j;
Glycerin, ℥ j.
Water, ℥ j;

One teaspoonful of the foregoing mixture will precipitate the caseine for one pint of cow's milk. The whey resulting from this precipitated milk I mix with whole milk, half and half, and heat until coagulation takes place. Then I beat the curd up into fine flakes. Now, on the other hand if the curd rejected from the child's stomach has not a distinctly sour smell, we can infer that the caseine coagulates before the digestive juices can act. In this class of cases, the addition of lime water to the food will often overcome the difficulty by making the milk just sufficiently alkaline to allow the digestive process to start before coagulation commences. With this agent the amount of alkali necessary is very small. The following is the mixture which I have found the best: lime water, two tablespoonfuls; water, four tablespoonfuls; and milk, six tablespoonfuls. Here we have less than one grain of lime, which is preferable to any of the other alkaline salts, and there is no other alkali which requires so small a quantity to do the work, and which does not keep the stomach in an alkaline condition sufficient to interfere with the digestive functions. Very often in these cases of vomiting hard curds, the stools are very acid and of a vivid green color. This acid condition of the intestines is very often caused by the administration

of an alkali, because when the stomach is acid the intestines are alkaline, as they should be; but when you make the stomach alkaline, as is too commonly done by the physician, then the intestines become acid. Usually it will be necessary to continue the use of the lime water for some time, but the precipitated caseine mixture need only be used for a few days. Now, on the other hand, when a child is being fed on cow's milk properly diluted and sweetened, (?) and has an acute attack of diarrhoea, the indications are to stop the milk immediately. There are many conditions of the cow that render her milk totally unfit for food. The first are her own physical infirmities. I have found that when a cow takes the bull the milk is intensely acid, and will cause a colicky diarrhoea in the infant that takes the milk at this time. Then when the cow is far advanced in pregnancy the nutritive value of the milk is diminished, and, furthermore, some food the cow takes affects the milk perniciously. Calves have been known to die sucking mothers who have eaten buttercups. I mention this plant because it is the most common. The cow is a voracious animal, and when she can get nothing better will eat all kinds of poisonous weeds, and this with impunity when she is giving milk. The same herbage which would and does

kill animals that are not in milk is eliminated by the milk-giver to kill the one who consumes the milk. Then again the brutal usage to which a cow is sometimes subjected, like the severe mental shock which often renders the human mother's milk poisonous, also affects the milk of the cow. I have recorded several instances of violent diarrhoea occurring in infants fed on milk from cows subjected to cruel treatment. When milk is stopped in acute diarrhoea, the food I use with good results is raw oat-meal water. The oat-meal water is prepared with one teacupful of oat-meal in one pint of cold water; let it stand fifteen minutes with an occasional stirring, and when the meal has settled, pour off only the clear water, and give this cold, *ad libitum*, either from a nursing bottle or a drinking vessel. The directions seem simple enough, but when I tell you in my experience not one mother or nurse out of ten will follow the directions, you will understand why I tell you to get this food prepared properly; you will be obliged to do it yourself the first time, and perhaps again and again. I do not know that this is to be much wondered at, for it does not seem to the casual observer to be a very nutritious looking fluid. But I have kept infants for several days on raw oat-meal water without apparent loss of weight. In many cases of acute

diarrhoea all the treatment you will find necessary will be the substitution of this raw oat-meal water for the milk they had been taking. Now as much depends on the proper preparation of this meal water, let me impress on you again the absolute necessity of you preparing the first portion yourself, and of seeing that the oat meal is good. Some of the oat meals in the market are prepared from damaged oats, which are partially cooked. When you attempt to prepare a raw oat-meal water from such a variety of meal, you will get too much starch in solution, and as a consequence the diarrhoea will be aggravated. Oat meal—the Ohio meal—is the best. I have never made a complete analysis of this oat-meal water, but I have determined the amount of fat in a given quantity; also the amount of solid matter held in solution, and demonstrated the presence of sugar. Therefore, you see we have something like milk in composition, fat, sugar, and nitrogenous elements. In one ounce of raw oat-meal water I found four and a half grains of solid matter. I extracted three-quarters of a grain of fat. Usually the child with acute diarrhoea is feverish, and will drink a large quantity; but it is easy to compute how much solid material they are getting. Notwithstanding all the scientific data that a child needs more food in proportion

than an adult, it is surprising how little they will get along with if that little is appropriate. This appears, likewise, to be the case of the young of other species. I have raised a calf on hay-tea from birth, and in a good, well-nourished condition.

Now, as I said before, it is always well to get the child back on its ordinary milk diet as soon as possible. Always boil the milk for the first two or three days when resuming it, after diarrhoea, and it is a safe proceeding to change the milk-man about this time.

It may not be out of place, right here. to tell you the kind of a cow best adapted to supply milk to an infant, and how the cow should be cared for to produce the best variety of milk. In the selections I exclude the Alderney and her cousins the Jersey, and Guernsey. In the first place they are exceedingly nervous, and there is little doubt that they are more prone to tuberculosis than any other breed, owing to the close in-breeding. Next, their milk contains the fat in a very poorly emulsified condition, which accounts for their good butter qualities. The fat exists almost entirely as free fat, and very little, if any, is combined with the albuminoids. The best cow to supply milk for infant feeding is the common-grade cow. In my experience the big

red breed is the most quiet and gentle in disposition, a good feeder, and not excitable even in heat. She should be stall-fed at all seasons when supplying milk for an infant. Her fodder should be fresh hay the first thing in the morning, after milking give her a breakfast of cut hay wetted and mixed with one pint of cornmeal, two quarts of bran, one pint of oil meal, one ounce of bone meal, one ounce of salt. She then should be curried and turned out for exercise into a yard where there is abundance of clean water. At noon she should have half a bushel of cut-roots, either carrots, mangel-wurtzel, or ruta-bagas. After milking in the evening give her the same allowance that was given at breakfast.

As I have been recommending stall-feeding the question naturally occurs, why is not the milk rendered poisonous by the weeds in the hay as well as in the pasture? This question at first staggered me, but when we come to know that almost invariably they owe their poisonous properties to a volatile principle which becomes inert by drying, the difference is understood at once.

When we rely on the milk-man for a supply, never take one cow's milk, for it never is uniform, while that of a large dairy will be uniformly good or bad.

All the difficulties with insufficiently fed child-

ren are not included in vomiting and diarrhoea. We also have obstinate constipation to deal with. In these cases I add cream and use raw malt water as a dilutent for the milk. Get whole-malted barley; in cities it is readily obtainable at the breweries; grind it in a coffee mill; soak half a pound in a pint of cold water for several hours and strain; dilute one-half with milk. In cases of badly-nourished children, who have but one movement in three or four days, and then the feces consist of a large white mass with a very bad odor, the malt water, in my hands, has usually regulated the bowels, giving a good soft yellow fecal discharge daily. In this same class of cases if the bowels become too loose, boil the half pound of ground malt with the pint of water for fifteen minutes and strain; dilute with it the milk in the same proportion, half and half. When malt water is being used, the milk requires no other sweetening.

In acute dysenteries occurring in artificially-fed infants, I have used the raw-beef solution, and have found in many cases when children have been doing well on this, that the administration of even one additional meal of milk would aggravate the dysenteric symptoms. In this disease I am not talking from a very large experience, but I went through one very severe epidemic, and the

experience gained at that time has been confirmed by my observations in sporadic cases since that time. I prepare the raw-beef solution as follows: one pound of lean beef, cut very fine, place in a quart fruit jar, then mix one pint each of boiling water and cold water; after they are mixed pour them on the beef; with a fork whip the beef up in the jar for fifteen or twenty minutes, or until the meat is all washed out, leaving it white; this allows the beef to settle, then pour off the clear solution; this should always be fed warm. My experience is that cold drinks are always bad for infants with dysentery. Sometimes I use this beef solution as a change of diet in other conditions, in which cases I add a little salt, or sometimes lemon juice, and administer it ice-cold in febrile conditions. But in dysenteries I make no addition whatever and always administer it warm.

Food and drink are synonymous terms to infant feeding; therefore the food should always be largely diluted. The kinds of food found in common use are often more correct than the methods of their preparation or administration. Usually each food substance carries with it a digestive ferment. Bread made with baking powder should not be used as food for children; such bread contains chemical substances which are not

wholesome. It must be remembered that food that spoils quickly digests quickly; but it must also be borne in mind that in infant feeding the digestive process should precede the spoiling process. This is not of so much importance with the adult where there is a stronger gastric juice to check the spoiling process. Therefore all preserved foods have their nutritive value lowered in proportion as their keeping qualities are increased. Letheby's tables of nutritive equivalents place human milk at 100, and Herring's at 914. The difference in digestive capacity is more than compensated by the difference in nutritive value.

With the short space of time allowed at such an important meeting as the present, I have made my remarks brief and pointed. If, however, I have succeeded in rescuing the infant from the multitude of fictitious commercial compounds, and saving it for a more natural, simple, and appropriate diet, I have not wasted your time, nor yet my own.

[Reprinted from the "Archives of Pediatrics," July, 1888.]

FERMENTED MILK.

From the most ancient times milk has been esteemed as of great value for human food. Among the more civilized races of mankind this article has been used fresh, and manufactured into butter and cheese, but among the uncivilized and semi-civilized races the latter preparations are little known, and the milk of their animals is principally used after it has undergone various forms of fermentation. Thus the Scythians, Tartars, the nomadic tribes of the Russian steppes and Western Siberia, transform their milk into kumyss. The Arabians use a fermented milk called *leban*, the Turks also ferment their milk and call it *yaourt*, while some of the other Oriental tribes designate their fermented milk as *keschk*, *karagart*, and *jourt*. In some parts of Asia, where the natives like to season their drink with red pepper, they relieve the burning of the mouth by drinking milk that has undergone a spontaneous lactic fermentation—that is, common, sour milk. This variety of milk is now be-

ing sold in New York as one of the fermented milk foods. The Caucasian mountaineers ferment their milk and call it *kephir*. This beverage attracted the attention of the medical men on the Continent because in some respects it resembled kumyss. Professor Struve was, I think, the first to call attention to it, but, according to this authority, its preparation was surrounded with mystery, and the ferment used could only be obtained from the mountaineers. The ferment was called kephir grains. P. Kern seems to have been the first to procure these grains from the Caucasians, and described them in 1882 in the *Bot. Ztg.* and in the Bulletin of the Moscow Imperial Natural Society; he called these granular masses *dispora Caucasica*. Because of the mystery surrounding this ferment and the manner in which it was presented to the public, the beverage formed by its action attracted considerable attention in Russia and Germany. Such men as Hueppe, De Bary, and others took up the subject, and it became quite popular. Still, the source from which the Caucasian mountaineers obtained their ferment remained a mystery; nevertheless, like many other medical profundities, these kephir grains suddenly became an article of commerce, and the market was well supplied at a high rate. When this Continental beverage

was at the height of its popularity, I procured half an ounce of the grains at a price of one dollar and a half. After extended experiments with the ferment, I reached the conclusion that it was very weak in its vinous action, as a larger amount of the milk-sugar was changed into lactic acid (and this change is what takes place spontaneously in milk when no agent is added), and the amount of alcohol obtained by the kephir was very small, being in all cases less than one per cent. It is a well-known fact that in conducting the process of alcoholic fermentation, the more we complete the vinous destruction of sugar the more completely do we guard against the other and more dangerous changes that take place in nitrogenized foods.

Now let us see what this kephir ferment is. Professor A. De Bary, of the University of Strasburg, says, "The hay-bacillus-scum is properly zoogloea, with a special characteristic form; formations, more or less like it, are found often enough in fluids containing decomposable organic bodies; highly characteristic zoogloea developed in a fluid are the frog spawn, bacterium of the sugar-factories and bacterium of kephir." Thus we see that kephir is largely a zoogloea, very much like the mother of vinegar and such like diseased masses of fermentative bodies. De

Bary further says, "The kephir grains are in their first living state white bodies, usually of an irregular roundish form, equal to or exceeding a walnut in size, chiefly composed of rod-shaped bacteria and numerous groups of sprouting fungi, living and growing in common with the bacteria." Crookshank, in his "Manual of Bacteriology," describes the kephir ferment as *bacillus Caucasicus*, "rods forming two spores, one at each end, otherwise similar to *bacillus subtilis:* they occur in the form of whitish lumps, in company with *saccharomycetes mycoderma.*" Thus it will be seen that in these kephir grains we have a mass of micro-organisms procured from the dirty skin-sacks of an uncivilized race of dirty people. In this age of bacteriology, in which we are able to separate and cultivate any of the germs we wish to produce a desired effect, it seems strange that we should go to an uncivilized race and procure the accumulating mass of diseased germs that has been gathering for years in their dirty skin milk-sacks. And this simply because some one proclaimed the derivation of the ferment a mystery.

But the strangest part of this kephir craze in Continental Europe was the discovery, by Alexander Levy, in 1886, that effervescing alcoholic *kephir* can be procured without any kephir grains

whatever, by simply bottling the milk and shaking it with sufficient violence while it is turning sour. This form of fermented milk gives nearly double the percentage of alcohol that is obtained from milk to which the kephir grains had been added. Thus we see that the addition of these masses of zoogloea rather retards than accelerates the change we wish to produce. Professor De Bary, who had devoted a good deal of attention to kephir, describing the process with minuteness, after he had verified, with the assistance of Professor Schmiedeberg, the correctness of Levy's discovery, says, " Our former explanation must therefore be abandoned, and there is no other at present ready to take its place. *But the case is full of instruction for our warning.*"

Since the pricking of this Caucasian milk-bag in Continental Europe, thus destroying the market for the sale of kephir grains, the French and German kephir manufacturing companies are establishing themselves here, and using the old and exploded medical testimonies to develop the business which had exhausted itself in their own land.

Professor Taylor, of Cincinnati, in the May number of the *Archives of Pediatrics*, makes some statements in his article on " Kephir, and its Use as an Infant Food," which I wish to question. I

do not, for an instant, doubt the correctness of his observations of cases, but it is a well-known fact in all hospital experience that in the trial of all new preparations, no matter what the ultimate result may be, the patient seems to get better, and the explanation of this phenomenon, plain enough to many a hospital interne, is that while patients are under observation for the trial of new treatment, the care and attention given them is always much greater than that bestowed on patients undergoing a routine method of treatment. We can all remember articles that raised our hopes from the glowing accounts collected at the hospitals, and that were finally abandoned as useless. But the professor's statement that "the presence of lactic acid has a germicidal action upon a large class of micro-organisms, and thus acts as a purifier of the milk," is decidedly wrong. The large class of micro-organisms which he adds in his kephir ferment certainly do not seem to be affected. Lactic acid in milk is not a purifier, it is simply a forerunner of putrefaction. In his description of the putrefactive process in "animal alkaloids," Brown says in his book, "The mass-residue exhibits a progressive *role* of fermentation; at first the *lactic*, then the butyric, and so on, giving the finishing characteristics of the putrefactive con-

dition." This is simply what takes place in milk exposed to the air; the lactic fermentation first and then the butyric; until these have completed their *role*, bacteria termo and the other micro-organisms that appear to produce putrefactive changes cannot act. Therefore lactic acid is not a purifier, but a dangerous body in nitrogenized foods. It is simply lactic-acid fermentation that has taken place in certain articles of food, and the putrefactive germs first commencing their life, that produce the violent attacks of choleraic diarrhoea that seize persons who have eaten food that has turned sour. Such a careless statement as this of Professor Taylor should not, I think, be allowed to pass unchallenged. Lactic acid in food must always be looked upon as a dangerous body; it is a far different substance when used medicinally in its free state than it is in combination with nitrogenous bodies undergoing fermentative changes that result in the dangerous alkaloids produced by putrefactive ferments.

Professor Taylor seems to know as little about kumyss as he does about kephir. One might infer from his expressions that the only genuine kumyss is that made in skin-bags of the Bashkirs in their old traditional way, and that all other kumyss, no matter how much intelligence is displayed in its manufacture, is in disrepute; while,

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on the other hand, kephir can be made without any intelligence by any one who possesses the ferment without knowing whence the ferment is derived or what action is set up by this mass. When one prepares kumyss intelligently one knows exactly what fermentative changes are to be produced, and can, therefore, select the proper ferment for the purpose. But this, according to the professor, does not possess the virtues of a genuine article, while a mass of diseased fermentative germs with a variety of bacteria and fungi, of which no man knows which will predominate, this makes genuine kephir.

[Read at a Meeting of the American Medical Association at Newport, R. I., June 25, 1889.]

COW'S MILK FOR INFANT FOOD.

In India, several years ago, one of the Hindoo Kings, "in order to atone for his cruelties, caused a colossal golden cow to be made, through the body of which he passed with profound reverence and made it the era from which all his edicts were dated."* This historical fact is significant. We have practiced all manner of cruelties with the luckless infant deprived of its mother's breast; we have presented all manner of unfit substances to this small animal whose only language is a cry, whose only desire is food. In fact, whenever a commercial enterprise finds itself burdened with some waste product that cannot be put to other use, it has been deemed a good substitute for mother's milk, and straightway the market is stocked with another "Baby Food," and physicians ready to recommend it and plenty of babies ready for martyrdom. Now, how can the physicians of the nineteenth century better atone for all their cruelties toward the human

*India and the Hindoos. F. DeW. Ward, 1850, page 34.

young than by causing a better cow to be reared, and from henceforth base all their edicts on the artificial feeding of infants on this better cow with a better milk product? I think that with few exceptions we are all agreed now that nothing excels good pure milk from good healthy cows for the artificial nourishment of infants, and if the great body of physicians put themselves about it with anything like the same energy they have displayed in supporting substitutes they can so reform the breeding of dairy cattle and the handling of their milk that the suffering of the human young will be ameliorated to a far greater degree than was ever hoped for by the astute chemist who started out years ago to make not only a substitute for cow's milk, but also for that of the human mother.* It is this idea of a substitute that has led us away from the more important consideration of improving what nature has already presented to us. Just look at the improvement in the commercial line that the middlemen have made in their milk transactions. These men have reduced the purchasing of milk to a nicety hardly surpassed by the purchasers of

* "Now, I have come to the most important matter of the lecture, and that is the consideration of the proposition at one time sincerely made of substituting some other food for human milk as being a better food for infants." Abstract of a lecture before the New York Academy of Sciences, by Prof. Albert R. Leeds, Ph. D., of the Stevens Institute of Technology, "Sanitarium," May 24, 1883, page 325.

gold and diamonds; they have worked down the price of milk from the producer to the lowest possible point; they have dropped fluid measurement and adopted weight as being more accurate; in butter factories they have invented an oil test that will indicate in a very short space of time the exact amount of butter a given quantity of milk will yield, and on this test the price of the milk is regulated; likewise the cheese factories have established a standard of solids in milk which also regulates the price. But all the improvements these men have made do not help us notwithstanding the fact that our chemists, sanitarians, health authorities have followed in the wake of these men and endeavored to make us believe that the healthfulness of milk is dependent upon the total solids, fats, etc., that relate solely to its commercial value. A larger percentage of fat that is easily removed from milk does not improve it for our purpose; it matters very little to us whether a given quantity of milk contains 12 or 14 per cent. of solids.

In milk for infant feeding we should consider first the variety of fats, the manner in which they are emulsified and combined; second the amount of albuminoids and their condition; third, the amount and variety of salts; fourth, the health of the animals from which it is derived, and the

food that has been consumed to produce the milk, and fifth, the changes which the milk has gone through before it reaches the infant's stomach. When we come to understand all these conditions we shall readily perceive just what kind of milk we want, and exactly the kind of cow which, with a given variety of food, will produce the very best substitute for the infant in lieu of its own maternal breast.

Let us then first consider the fats. Taking the human milk, which should always be our standard, we find these solids according to the best authoritative analysis occur in proportions of 2.11 to 6.89.* Now this makes an average of 4.131, for human milk. From several hundred analyses of cow's milk in different parts of France, England and America, the average of the chemist is 3.91. Thus you will see the difference, according to the chemist, between the two varieties of milk is very slight. I know, however, from the actual experience of practical dairymen that cow's milk contains more fat than is indicated by the above figures. The lowest amount of butter obtained from mixed milks is one pound of butter from 25 pounds of milk. This would make the fat percentage 4. In drawing this de-

* Composition and Methods of Analysis of Human Milk by Prof. Albert R. Leeds. Transactions of the College of Physicians of Philadelphia. Third series, Vol. VIII, p. 248

duction I am well aware that a pound of butter is not a pound of fat, but a pound of butter obtained from a given quantity of milk represents a pound of fat in that milk, because the quantity of fat in a pound of butter is exactly 84 per cent., and, according to the latest experiments at agricultural stations only 84 per cent. of the fat can be obtained from the milk by the process of butter-making. Now, this percentage of 4 is a low practical estimate of the quantity of fat, for among dairymen with special breeding and feeding they get as high as one pound of butter from 14 pounds of milk, that is 7.13 per cent. This is a higher percentage than has been found by any chemist in human milk. This is a practical fact, not chemical inference. It is very easy to understand where the fault in chemistry has been. The fat in milk is dependent upon the food the animal receives more than are the albuminoids, and we all know that very many of the varieties of fat contained in cow's feed are volatile, and the chemical methods of using heat dissipate these varieties of fat; hence the low percentage obtained by chemists.

We must all admit that the fats contained in human milk, the product of an omniverous, largely carnivorous animal, consuming fixed and more stable fats, differ from those contained in

the milk of the cow, a herbivorous animal whose food holds more vegetable, volatile and unstable fats. Practically one is a yellow, unctuous, pleasantly odorous fat, as we see in butter, the other is colorless, waxy, decidedly different in odor, and therefore it can be easily understood that the chemist who is obliged to use heat will recover more fat from the human than the cow's milk. Thus we see that the fat is largely dependent on the nature of the food, and from the dairyman we learn that we can regulate the food of the cow so as to materially affect the proportion of fat secreted. We know very little about the chemistry of fats; as far as I have been able to ascertain there has been but one analysis of cow butter fat made up to the year 1875. Wherever we turn, the analysis of Bromeis confronts us, and later English analysts, while finding this analysis all wrong, are unable to give us a correct one. These later analysts,* without ascertaining the proportions, found in butter palmitin, palmitic acid, stearin, stearic acid, olein, oleic acid, butyrin, butyric acid, caproic acid, caprylic acid and capric acid. The fat of human milk has also been analyzed by Robin several years ago and also copiously quoted. I think

* Hahner and Angell. Butter: Its Analysis and Adulterations. London, 1877.

that it is due to us from the chemists that we have some authoritative analysis of these milk fats, that we may know which, if any, of the fatty acids are the mischief makers in milk, for I have no doubt that the glycerides and fatty acids from the decomposition of milk have more to do with the development of poisons than the albuminoids have. The present popular method of analyzing milk by heat undoubtedly decomposes the fats, as is evidenced by the skin that forms on the surface of boiling or evaporating milk. This skin is undoubtedly the oxide of lipyl; it was at one time considered that it was coagulated albumen, but it does not form in vacuo, and will continually form on the surface of boiling or evaporating milk as often as you remove it, and resembles very much the skin which forms on old paint pots that have contained vegetable oil. Furthermore, the condensation of milk for commercial purposes does not preserve the fats; hence condensed milks are more or less skimmed, the better varieties having only the more volatile fats removed, otherwise they would become rancid. I am coming more and more to consider that the fats in milk are the bodies most likely to cause the digestive derangements of infancy, and when we know more of the composition and combinations of those bodies occur-

ring in milk, many of the poisons, notably tyrotoxicon, will be less of a mystery than they are now.

Our second consideration will be directed to the albuminoids. Some time ago there arose a mild dispute between two chemists as to the amount of the albuminoids occurring in human milk; Professor Meiggs asserting that there was only 1 per cent., while Professor Leeds makes the variation of from 0.85 to 4.86, an average of 1.195. Koenig, an earlier analyst, makes the variation from 0.57 to 4.25. Some of these results give as high a percentage of albuminoids in woman's milk as we find in cow's milk, and I have no doubt in my own mind that the time and habit of extracting the milk has a deal to do with the amount of occurring albuminoids. In other words, when milk is extracted every two hours or less, it cannot contain as much of the cell material as milk from the same source extracted at intervals of twelve hours. This latter is riper and it is the nonuniformity of the tissue which causes all the difference in the different occurring albuminoids. We know that during the incubation of eggs caseine is developed from egg albumen. This illustrates the ripening of albumen. Furthermore, take an egg just laid by the hen and boil it and you will find immature

albumen in it, that is, after boiling, instead of being thick and firm, like an older egg, much of it is milky. If boiled a few hours later, all the albumen will coagulate perfectly, because it has had time to ripen. There is no doubt that the albuminoids in milk from healthy animals are all cell transformations, not an exudate, as are undoubtedly the fats and salts, because these latter we can influence by the food very plainly, but in health the albuminoids are constant without regard to the food, while during menstruation, pregnancy and other conditions, notably febrile disturbances, we find the fats and salts not materially affected, but the albuminoids are decreased, increased or totally changed, as we find in colostrum. The caseine, besides being riper in cows' milk, by reason of its stronger growth, is intended by nature to coagulate into a hard mass, because it is the product of a cud-chewer for the nourishment of a cud-chewer, and the reason why it does not always coagulate in the infant's stomach as it does in that of the calf, is, that the latter animal's stomach secretes a principle called chymosin; this is the principle that curdles cows' milk, and it operates either in an acid or an alkaline medium. Pepsin will not coagulate milk, and hence the hard coagulum of cows' milk that sometimes forms in the infant's stomach is due

to acidity of that organ, and this acidity is not always the fault of the stomach, but of the milk itself. The variations in the chemistry of the albuminoids found in cows' milk would not be surprising to any one if he would examine into the condition of some of its mammary sources, for often it will be found on dissecting a cow's udder, which I always do when making an autopsy on a cow, that there are old cicatrices, one or more quarters of the udder intensely inflamed, sometimes a mammiferous duct clogged with a calculus or a clot of fibrin, and besides these pathological conditions, the mammary gland is subject to benign and malign infiltrations, bacillary tubercular deposits and eruptive diseases of the skin involving the gland and dugs; therefore, that fibrin, serum, albumen in various forms, are found in the cow's milk is not surprising, and it can safely be assumed that any variation in the albuminoids from the normal caseine can be ascribed to sickness on the part of the animal.

We next come to the salts contained in milk, and it is remarkable how few analyses have been made to determine the salts or minerals that are contained in this fluid. Heidlin's analysis, copied everywhere, seems to be the only exhaustive one of the salines in cows' milk made during the present century. It seems to me in this case,

too, that it is time for the chemist to teach us something more. There probably never was a time, in our era at least, when milk was attracting so much attention as now, and still all our chemists are content with the total solids, fats, albuminoids and sugar — just what the butter and cheese-makers want to know. From this much-quoted analysis of cows' milk salts we learn that milk contains in varying proportions the phosphates of lime, magnesia and iron, the chlorides of potassium, sodium and iron and free soda. Robin gets from human milk, in addition to the foregoing, carbonate of lime and soda, phosphate of soda and the sulphate of soda and potash. We have no means of knowing how constant is the occurrence of any of these salts in milk or under what conditions they are modified; we do know, however, from the experiments of Fehling, that many of the drugs administered to the milking female are excreted in the milk. Therefore, we can safely assume that the saline constituents occurring in milk are influenced both by the health and food of the animal. That the phosphates are craved for by the milking cow is evidenced by the habit of chewing old bones and the like, and that there is a lack of this element of food is not to be wondered at when we see herds of milking cows pastured on

old worn-out lands; the practical farmer knows that exhausted pasture lands need more than anything else for their rejuvenescence the phosphates, and we know that in our nutrition we need them also. The land on which a cow is pastured will indicate pretty fairly what we may expect to find in her milk as salts. We have all noticed the excessive growth of sorrel on exhausted land, and can it then be a subject of wonder that some kind of a vegetable acid should be found in the milk of animals that are obliged to include this variety of food in their summer rations and sour ensilage or spoiled brewery grains in their winter feed. Theodore Hänkel's discovery of citric acid in cows' milk to the amount of 0.9 and 1.1 grammes per litre is just what might be expected.

Sugar, I think, in milk has always been overestimated as to its nutritive value, because we know that carnivorous animals do not secrete sugar to any appreciable extent, at least so the chemists tell us, and when we see a small slut* nursing seven or eight puppies and keeping them all fat and in a thriving condition, we can easily imagine that sugar is not one of the necessary elements of food; while, on the other hand, we know that the gross result of condensed milk

*The canines excrete no sugar in their milk.

feeding where the sugar is in excess is not good. In regard to using the commercial sugar of milk as an addition to cows' milk for infant feeding, I think it is a mistake, as there are undoubtedly all the other crystallizable milk salts with the milk sugar, and consequently we can know very imperfectly what we are feeding an infant with when we are giving milk sugar. If the milk from which the sugar was crystallized contained improper vegetable salts, those would undoubtedly become crystallized with the sugar, and many of the proper salts would have become changed to the lactates. Therefore, I think if sugar is to be used at all, although I deem it of doubtful necessity, the pure cane sugar is undoubtedly the best because you know just what it is. When we consider the chemistry of milk as we find it in the books, what does it all amount to? The chemist has given us to understand that the needs for bodily nourishment are a certain amount of the albuminoids carbohydrates, fats and salts. We can, therefore, from some of the cheap cereals make this ideal food, and for one cent have as much in nutritive value as we get in milk at a cost twenty or thirty times greater. Then, why do we give milk? Because we have tried the chemist's ideal food with the infants at least, and however admirable the theory may be,

in practice it is a failure. Nature does not make so close an allowance that there is nothing to spare and no margin. She does not measure food by the rule of three, always exactly in the same proportions. Let us examine the work of the chemists themselves, and we find in human milk a standard that we cannot ignore, the albuminoids varying from 0.85 to 4.86. Therefore, let us not deceive ourselves with the popular error of the day, namely, that milk must contain just such a proportion of solids, and solids not fat, and so forth, to a chemical nicety, but let us look into the cow-house and see what goes through the cow to produce the food for infants and what kind of an animal she herself is. Prof. L. B. Arnold, as good an authority as we have in this country on dairy matters, says: "Milk is the scavenger of the cow's body." What would be the sense of taking a sample of water from a sewer and asking a chemist to examine it for sewage, and so when we go into a dairy stable and see dirt and filth, disease and improper food, need we ask the chemist to ascertain the total solids, fats, etc., to find if the milk is fit for infant food? When this fluid will not properly nourish an infant it is not cows' milk, *per se*, that is at fault, but it is either a pathological condition of the cow or improper food or care or the condi-

tions through which the milk has passed on its way from the cow to the infant. It is safe to say that if we had directed the same attention to the cow, and if the same amount of money that has been spent on the various substitutes had been devoted to the improving of her condition, the infant at least would be better off.

Now we can assert that cow's milk is the best food for the artificial feeding of infants, and when this fails the fault lies in one or other of the following conditions, or several of them combined: First, a faulty condition of the cow herself, and this will be indicated by the condition of the albuminoids; second, improper food or an improper manner of feeding and caring for the animal, and this will be indicated by the fats and salts; third, improper handling of the milk after it is taken from the cow, and this will be indicated by the ptomaines and extractives. A proper understanding of these three sources of danger will make the feeding of infants a simpler matter than that offered by any of the substitutes, and be at the same time a more rational method. We shall consider the conditions of the animal that render her milk unfit for food. The cow is an unique beast, differing in many respects from any of our other domestic animals. One of her peculiarities that has caused a great

deal of confusion among veterinary writers is her normal temperature. Several years ago I searched diligently in books devoted to bovine pathology to find the normal bodily heat of the cow, and the confusion was puzzling. It is variously stated at from 98° to 101° Fahr. I, myself, made several hundred thermometrical examinations, under varying conditions, and found that the temperature is not constant in apparent health, as it is within very narrow limits in the human subject. Of course we cannot tell to a certainty how near to health a dumb creature is. The standard that has been adopted with these animals is that they are in health when they perform their functions with profit to their owners. Certainly, there are many slight ailments that do not carry the animal beyond this limit. Therefore, the varying temperature in the cow may be due to slight ailments that do not demand the attention of the veterinarian. The average temperature of the cow in apparent health I have found to be 102½° Fahr., ranging from 101½° to 103°. This you will perceive is a peculiarity of the cow, and none of the other large domesticated animals maintain so high a bodily temperature. Another peculiarity of the cow is the constant employment of her generative functions. She is always milking or

pregnant, and both the uterus and the mammary glands are employed almost constantly at the same time. Hence, her nervous functions are exaggerated. Therefore, with an abnormally high temperature, for I have found that bulls and steers have not so high a temperature as the milking cow, and with an unnatural functional activity of the organs of generation, she is used also as a machine to transform food into milk, and it is astonishing to what capacity she has been trained in this direction. With four stomachs, the first alone with a capacity of sixty gallons, she simply eats, and she will eat anything; in health she is always either eating or chewing her cud, and her pedigree sometimes shows the closest consanguinity in her breeding. Now when we consider all these unusual conditions is it at all to be wondered at that the ordinary dairy cow is as a rule an unhealthy animal, more prone to bacillary phthisis and scrofulous affections than other animals? Her nervous system is more subject to severe shocks, and in fact she is a delicate creature, her attendants are not usually either mild or cleanly, nor is her housing always the best.

Our next consideration is the feeding and care of this nervous and delicate animal. The ordinary dairyman receives for his milk $1\frac{1}{2}$ to $2\frac{1}{2}$ cents

per quart. At this low price received by the producer he cannot usually give his cattle the best food. I noticed in a dairy journal this summer an estimate from the New York Dairy Commissioner. Taking the milk received at the creameries as a basis, the average income from each cow is about $20 a year to the producer. This is almost seven cents a day, from which the dairyman has to buy food and pay for labor. This sum alone would not begin to pay for proper food for the animal, hence the farmer is driven to every known expedient to keep his cows in milk, and the profits being so small, if there is any profit at all, he must utilize every drop of milk, whether the animal giving it be sick or well. In this state of affairs is it not natural that all the cheap foods, such as brewery grains, distillery slops, the refuse from starch factories enter so largely into the food from which our babies' supply of milk is produced? Of course this condition of low price and improper feeding does not apply to every dairy, but after years of experience I have no hesitation in saying that it applies to the great majority of dairy farms, surrounding New York city, at least. I have personally inspected small dairies where the sole article of diet was swill, gathered in the city. Good food is to the cows of course the prime

absolute essential for the production of good milk, and unless the public are willing to pay more for their milk than they do at present a reform in this direction cannot be expected.

The handling of milk after it leaves the cow is the next important consideration. Owing to the cow's natural high temperature, 102° to 103° Fahr., the milk when drawn must cool rapidly, and this first cooling taking place in a cow-house, the milk is, of course, more or less affected by the conditions generating odors. If these odors are not very bad they can be removed more or less perfectly from the milk by a process of aeration. This can be accomplished readily by pouring the milk from one vessel to another in a thin stream in the presence of a pure atmosphere, or on a larger scale by pumping pure air into it by a suitable machine. One of the most dangerous methods that I know of for killing the odors that milk absorbs from dirty stables or improper food is that recommended by many practical and otherwise sensible men, namely, the addition of nitrate of potash, that is, common saltpetre. It is very easy from this addition of nitre, combined with the glycerides and sulphates already contained in milk that is decomposing, to figure out chemically bodies approximating to nitro-glycerine. It is suggestively strange that the

toxic effects of nitro-glycerine are similar to those of tyrotoxicon. The often-reported detonation of this latter extractive while undergoing examination in the laboratory is also suggestive of the properties of nitro-glycerine. The addition of chloride of lime which is also recommended for the same purpose, although apparently a less dangerous chemical compound, should nevertheless be prohibited. Soda is also added to milk sometimes to delay the souring process. The prohibition of this chemical may be viewed in the light of a stultification when we consider the large amount of bicarbonate of soda that is used at the present day in one of the popular methods of feeding infants. I think it is no less reprehensible on the part of the physician than it is on the part of the dairyman. No chemical substance whatever should be added to cow's milk by the dairyman. Milk that is procurable too far away to reach the child within a few hours should not be used for infant feeding. The different degrees of temperature through which it must pass in its transit by country wagon, railroad train, and city express are productive of changes that cannot but deteriorate the quality of the milk. It is well known that light as well as heat is one of the elements that hasten de-

composition in milk, hence the now popular method of serving milk in clear glass bottles is also a popular error. No milk should be served by the milkman for infant feeding after it is twelve hours old, nor should it be served to the infant while it is warm, immediately after leaving the cow, for I have found by actual experiment that cow's milk while still retaining the animal heat, if taken into the stomach, would coagulate into a solid mass, but this coagulation was not so hard and rubbery as the curd we see sometimes formed when milk is too old. In regard to sterilized milk, I am of the opinion that it is far better for us to make an effort to improve the quality of milk to such an extent that it will be needless to sterilize it, because, of course, sterilized milk must take its place with condensed milk and other varieties of preserved food. If we cannot improve our milk then, of course, sterilization ought always to be practiced; notwithstanding that it is a preserved food like condensed milk it is not necessarily skimmed or sweetened as the latter is.

Having thus outlined the condition of the milk we get and the reasons why it is not always good, let me in the next place suggest remedies for the existing evils. First, in regard to the cow herself. No cow that is bred for a butter-maker

should ever be used to furnish milk for infant feeding. The ideal butter-cow is too closely inbred, and consequently too nervous; there is too much free fat in her milk. The ideal cow to furnish milk for our purpose should not be too finely bred and with little, if any, consanguinity in her breeding. She should not have had her first calf till she was in her third year; her milk should not be used after she is six years old, unless she has been spayed; she should be of a quiet disposition; her surroundings clean and quiet; she should be stall-fed always while giving milk for infants; her food should be hay without weeds, ground oats, bran, flaxseed meal, roots (beets and carrots), bone-meal and salt, in the winter corn-meal in addition and in summer in lieu of dry hay, green cut clover or grasses free of weeds. She should be curried daily and well bedded, and in the winter the water she drinks should be slightly warmed. The milk should be aerated and cooled as quickly as possible. It should then be put into opaque bottles and securely closed.

Now, why do we not have this kind of cow and obtain this quality of milk from our milkman? The very first and prime reason is that milk is sold altogether too cheap. The producer, as I have before mentioned, gets about two cents

a quart. The railroad or the carrier gets one cent a quart for all handled, and the distributor gets five cents a quart for peddling to the customers. Therefore, the consumer pays eight cents. This variety of milk does not usually agree with the child, and therefore the consumer is advised to buy some of the Baby Foods as an addition to the milk, and this increases the price of the food to something like fifteen to twenty cents a quart. Now, if the producer got this extra amount of money he could buy better food and better cows, exclude the milk of sick animals, and altogether improve the quality of his produce. But would he do it? That is the question. Still it would be more humane to make him do it when he is making a living than under circumstances as they exist now. So the question of a purer supply rests very largely with the medical adviser. Instead of recommending commercial Baby Foods in addition to doubtful milk, he should advise the parents to purchase milk at twelve or fifteen cents a quart, and when the infant gets sick from digestive troubles, then lay the blame where it is justly due, to the milkman, and he will lose his customer. The supply of baby milk in cities should be kept entirely distinct, and should be procured from those farms that are situated near enough to the customer to

get the morning's milk of the day of delivery. The dairies supplying this variety of milk should be under strict sanitary surveillance, for no matter how good a condition a cow may be in if she is in heat, has sustained an injury or is sick in any manner whatever, her milk should not be used for infant feeding until she has completely recovered. The ideal dairy for supplying infant food should be composed entirely of spayed cows, and thus one constant source of nervous functional disturbance would be eliminated. In my own herd I have several spayed cows whose milk I supply for infant feeding. These animals are much more quiet in disposition, they give a more constant and uniform supply of milk, and seem to enjoy a more even degree of health than the cow who is occasionally bulling and becoming pregnant when giving milk.

[Reprinted from "The Journal of the American Medical Association. July 5, 1890.]

THE USE OF COMMERCIAL MILK SUGAR IN INFANT-FEEDING.*

Some time ago a gentleman came to me, who had been sent by his physician for me to discover, if I could, what the trouble was with the milk which he was feeding his baby. He bought a sample with him, it was very slightly gray in color, and the caseine was precipitated in a fine granular deposit, the odor was slightly disagreeable. On inquiry, I found the mixture to be that known as the "Meigg's mixture" as recommended by Dr. J. M. Rotch in the article on "Infant Feeding" in Keating's Cyclopedia. After a thorough investigation as to the milk and cream, I could find nothing wrong with these constituents of the mixture. I then ascertained that he had been using the mixture for some weeks, and that he had not observed the foregoing change before. Then I questioned him as to what new conditions were existing when this change took

*Read in the Section of Diseases of Children at the Forty-first Annual Meeting of the American Medical Association, Nashville, Tenn., May, 1890.

place and I learned that he had just procured a new supply of milk-sugar. "But," he said, "It cannot be that for I got it where I have always bought it." I told him to go to some other store on his way home and get another supply and try that, and report to me the result. He returned in the afternoon and told me that the whole trouble had been in the sugar; because, when he went home and used the second lot, the mixture appeared all right, and to assure himself that this was the case, he again mixed a quantity with the first milk-sugar and found the same change taking place in the food mixture. I have ever since exceedingly regretted my foolish oversight in not securing the troublesome sugar. I thought I could look the matter up in the books and find there what the trouble was, but after diligent search I found that there was practically no literature on this subject. By this time the man had unfortunately thrown away the bad sugar. I have been ever since trying to find out what was in that sugar. It was purchased at a reputable first-class drug-store and the proprietor, I know, deals only with reputable high-class firms. I could not get a sample from him because he had returned it to his wholesale supplier when his customer made his complaint. Since then I have found that we know very little about this highly

recommended constituent in mixtures for the artificial feeding of infants. Hahnemann discovered years ago that the sugar of milk had the least appreciable effect on the human system of any substance he had tried, and hence, he recommended it as a vehicle for the administration of medicine. Previous to this its use was very limited and its manufacture was confined to Switzerland. Now, however, with our pepsine powders, tablet triturates and baby-foods it has become one of the regular articles of commerce, and its consumption is computed by tons; in short every creamery in the country where cheese is manufactured, milk-sugar is one of the by-products and large quantities are still imported. It is found in the wholesale market in large cobs with a stick running through the center resembling the barley-sugar of our youth and also in coarse irregular crystals resembling somewhat coarse salt, and in the retail stores we find it in the fine powdered condition. The market price last winter at the time of my inquiry was 14 to 18 cents per pound for the crystal cobs and 12 cents for the powders. No wholesale man of my acquaintance could enlighten me as to this difference. It is well known that milk-sugar is one of the difficult articles to powder properly, and there is considerable waste in the crystal owing to the

stick on which it is crystalized. This is not a scientific point, but it is one of the things which I learned during several years of intermittent investigation and it may be interesting to some people.

One of the faults of physiological chemists is, that they make no distinction between a substance existing in a natural condition and that substance eliminated and isolated by chemical means. Thus, the sugar of milk of commerce and the sugar of milk as it exists in that fluid are regarded by the chemist as one and the same thing. Hence, the physician has been led into the error of thinking that as the sugar in milk is that designed by nature as the best saccharine nutrient, therefore the isolated sugar must fulfil the same function. This is not the truth. Sugar of milk in that fluid is all assimilated, and the milk-sugar of commerce when added to baby food is eliminated both by the kidneys and bowels. This, I have demonstrated by numerous experiments. I have never found sugar present in the urine or faeces of babies fed at the breast, but in three cases of infants fed with mixtures containing commercial milk-sugar to the amount of three ounces or more in twenty-four hours (as in Meigg's mixture) I have always found sugar in the urine and faeces demonstrated by Fehling's

test. The faeces I macerate in boiling water, boil the filtrate and refilter, testing the final filtrate. I have never endeavored to ascertain the exact amount of occurring sugar, but the reactions have always been definite and well-marked. To-night I received two cubic centimeters of urine from a baby 10 months old fed on Meigg's mixture, and this tested with Squibb's standard Fehling's solution indicates .025 per cent. of sugar. Therefore instead of being of value as a nutrient it must be harmful, to what extent, I am not at present prepared to say. A substance that is not broken up in the system but eliminated without change, if it be not an absolute poison will produce little if any appreciable immediate effect. Hence, Hahnemann was right in his observation as to the effect on the system of administered milk-sugar. Routh also in his work on "Infant Feeding" recommends milk-sugar because it undergoes "fermentation less readily than the ordinary sugar." This statement has been repeated by nearly every one who recommends the sugar of milk as an infant food. I think this statement of Routh would be rather against any article of food because any substance that spoils quickly or responds readily to any of the fermentation changes will also respond quickly to the digestive ferments.

Relating to the fermentation of milk-sugar, I have made the following experiment. I took five test-tubes, and in each placed two drachms of a saturated solution of milk-sugar, each tube containing a solution from a different sample. Into each tube I dropped two drops of brewer's yeast; in twenty-four hours each sample responded to the test for alcohol by chromic acid. With these five tubes I placed at the same time a sixth containing a solution of cane sugar of the same strength as that of the milk-sugar solutions; in this solution also I dropped two drops of brewer's yeast. The cane sugar solution set up active fermentation in five hours. I allowed the six solutions to remain in a living room with the tubes open for three months. When examined after this length of time the water had completely evaporated leaving the tubes dry. The five milk-sugar tubes contained each a large mass of dried mould and some exhibited crystals of sugar on the side of the tube; while the cane sugar tube contained very little residuum. I added to each tube two drachms of water, the original amount of fluid, and I found that the cane sugar had entirely disappeared, while the milk-sugar tubes were each rich in sugar. And now after three weeks in the second solution with all its gathered mould and dust, the sugar is still there. So

Routh was right; it will undergo "fermentation less readily" than almost anything fermentable.

Another question that has occurred to me in connection with commercial milk-sugar is, how much sugar does a given quantity of the article purchased really contain? In view of this inquiry I made it a point at one time to buy five cents worth of milk-sugar in every drug-store I came to and thus I collected many samples. Out of these many samples I selected five and submitted them to the tests prescribed by the United States Pharmacopoeia. First, solubility. According to the Pharmacopoeia, milk-sugar is soluble in seven parts water at 59° Fahr. Sample No. 1, not completely soluble, after twelve hours a white precipitate surrounded by a black ring at the bottom of the tube; No. 2, slight black precipitate, enough to cause a decided opacity on agitating the solution; No. 4, solution remained slightly opaque and deposits a dark brown precipitate. No. 5, solution perfectly clear with a few grains of undissolved sugar at the bottom of the tube.

Tests for the presence of cane sugar according to the Pharmacopoeia: "If one part of sugar of milk be sprinkled upon five parts of sulphuric acid contained in a flat-bottomed capsule, the acid should acquire nothing more than a green-

ish or reddish, but no brown nor brownish black color within an hour." The following are the results of my application of this test: From portions of the samples above referred to, No. 1, blackish-brown; No. 2, dark brown; No. 3, reddish brown; No. 4, light red; No. 5, light red. The Pharmacopoeia also states that it is insoluble in alcohol, ether or chloroform. I found sample No. 1 lost 5 grains from $3\frac{3}{8}$ drachms by repeated washing with sulphuric ether and 11 grains by washing in absolute alcohol. No. 3 lost half a grain by washing with sulphuric ether. I did not test the other solutions in this manner, but I sent to James H. Stebbins, Jr., an analytical chemist residing in New York, samples No. 1 and 2 of the foregoing for analysis as to the quantity of sugar contained in each sample. I received from him the following reply:

Dear Sir.—The samples of milk-sugar marked as below submitted to me for analysis contain, No. 1, 94.38 per cent.; No. 2, 98.49 per cent.

These are specimens bought in the open market from reputable druggists, and such as are sold to the consumers for infant feeding. When we come to know the manner in which milk-sugar is procured, the only wonder is that it does not contain much less sugar than is indicated by the

above analysis. The milk is collected and allowed to stand for several hours in cooling vats; then, it is conveyed to a large tank to be coagulated. Various substances are used to hasten the coagulation. According to Flint* vinegar, cream of tartar, muriatic acid and sour milk can be used to produce coagulation, but of course rennet is the most popular and most commonly used agent. This, as we all know, is the fourth stomach of the calf. The directions given for preparing rennet are as follows: "Care must be taken not to use too much water in cleaning, wiping lightly with a moistened cloth until it is clean, is the better way. If then blown up like a bladder and hung up and dried, it will retain its power for coagulating milk for years." Pieces of this rennet are steeped in warm water, and the solution from it is added to the milk and then the milk is raised to a temperature above 100° and kept at that until coagulation takes place. Then the whey is drawn off and this whey is evaporated by boiling to one-fifteenth of its original bulk, leaving a brown, viscid, sweetish saline mass. This is dipped out into a tub where the sugar will crystallize in twenty-four to forty-eight hours. These crystals are known as "sand;" this sand is filled into sacks from which the water

*Milk Cows and Dairy Farming.

drains off. The sand is again boiled in water to a sufficient concentration and the sugar is allowed to crystallize in sticks. It will thus be seen that many of the other crystallizable bodies contained in milk would be included in this crystallization as well as the alkaloids of ptomaines.

I am exceedingly sorry that I have not had time to follow out all the experiments that have been indicated to me while making the few hurried inquiries relating to a subject, which I am positively sure will change the views of many gentlemen who have taken me to task for recommending the use of pure cane sugar as an addition to infant food when a sugar addition is needed. I really think that the addition of any sugar to good milk is overestimated.

111 East Seventieth street, New York.

August 25, 1890.

Edward F. Brush, M. D., Mt. Vernon, N. Y.:

Dear Doctor.—I write to you as chairman of the committee on public health of the New York County Homoeopathic Medical Society.

I am very desirous of having this Bureau be of some great practical importance, and the other members of the committee in conversation with me have agreed that we shall take up matters of the greatest importance at our meetings of report, and that one of the most important of all is the subject of disease contaminations through the medium of milk.

We look upon you as one who understands that subject in its most minute detail, and we all know you, and I voice the sentiment of our whole society, when I say we are anxious for your views on the subject.

Our next meeting will be on September 11th, and if you would grant us the favor of that time we would be greatly pleased, and I think you would not regret the effort.

If, however, that date would not suit you and a later one would, we bow to your will, and will patiently await the time when we may be instructed by your paper.

I am very truly yours,

J. B. GARRISON, M. D.,

Chairman Committee on Public Health.

[Reprint from The North American Journal of Homœopathy.]

SUGGESTIONS FOR IMPROVEMENTS OF THE DAIRY.*

Without definite knowledge on the subject, the almost universal belief to-day is, that the milk supplied to cities is not right; and without a unanimous agreement as to what diseases or other disturbing elements are spoiling the milk supply, there is an unsettled, perturbed feeling about the dairy products as supplied to large communities. The medical men are convinced that something is radically wrong, as evidenced by their fruitless efforts to improve the supply as they get it from the dealer, and now the doctors are becoming hopeless from the failure of sterilization, pasturzation, peptonizing, modifying with cream, milk-sugar, and the addition of the variously constituted patent foods. The health authorities, with a grim determination to keep at work, right or wrong, have satisfied themselves with total solids and fat percentages, and would have us believe that any milk containing 13 per cent. solids, of which 2.5 are fats, is absolutely

*Read before the Homœopathic Medical Society of the County of New York.

normal and healthy. With all these men the great trouble is that they have been working at the wrong end of the subject. If all the honest, scientific, painstaking work that has been done by the sanitarian and medical men had been directed to the dairy and the dairy cow, we should be far nearer to the solution of the difficulty than we are at present.

To begin with generation, the dairy cow is bred wrong. The scrofulous and tuberculous form has been the ideal in the mind of the dairy-cow breeder for generations, not because they recognized scrofula and tuberculosis as abnormal conditions, but because in this pathological condition the mammiferous animal becomes a larger milk producer, for the reason that scrofula and tuberculosis are eminently glandular diseases, and the mammary gland being the highest type of glandular structure, takes on an excessive activity under these conditions. During a number of years of close observation of dairy cows, I have found a sudden increase in the secretion of milk a pathognomonic sign of an active tubercular invasion, and I am always afraid of a cow that gives an abnormal quantity of milk. I do not intend in this paper to discuss tuberculosis as a disease conveyed to the human from the bovine race, but I mean to affirm that an excessive quantity of

milk from a tuberculous cow is exceedingly deficient in all the nutritive elements except fat. Hence the first reform in the dairy is to breed our dairy cattle for health and not as large, phenomenal milkers, for I can say without fear of dispute, that the healthy, robust and vigorous animal is never a large yielder of milk. The breeds of animals that enjoy a reputation for immunity from tuberculosis in this day of phenomenal milkers, are not classed at all as dairy cattle. The Aberdeenshire, a large and robust native of the Highlands of Scotland, generally supply only a quantity of milk sufficient for the nourishment of their offspring; these animals enjoy a reputation for immunity from tuberculosis. There are, of course, tuberculous cattle that are not bred for the dairy, but the same methods are followed in breeding them as with the tuberculous dairy animal, namely, in-and-in breeding of the closest consanguinity for early maturity and maternity. All consanguineously bred animals fecundate too early and thus add to their inherent delicacy. It should be the rule in all breeding herds that animals shall not have their first calf till after they are three years old, instead of seventeen and twenty months, as is now the prevailing rule in many dairies.

Hence the first recommendation is to avoid

consanguinity and not allow the heifer to become a mother until she is twenty-seven months old. This method of breeding I would advocate as the rule for cattle breeders, because I deem it absolutely essential that cattle-breeding and dairying should be distinct occupations. Years ago the English breeders found that they could not profitably breed an animal that would be fit for the butcher and the dairy; hence there arose the dairy-breeder and the beef-breeder. Now, after many years devoted to the subject of dairy cattle, I am convinced that a man cannot keep his cows breeding and milking at the same time, and supply a healthy food to the community.

In my opinion, then, the separation of the functions of breeder and dairyman is the first reform to be recommended. All the cows used to supply milk for food, especially for infant food, should have their ovaries removed. The first suggestion of this proposition seems, to the ordinary mind, preposterous, unnatural and cruel. It is no more unnatural than the castration of the male animal for the improvement of its meat for human food, and as to its cruelty, having performed the operation several times myself, I can conscientiously affirm that the pain of one parturition outweighs the suffering of the operation of spaying, if the latter is properly performed.

The operation of spaying is by no means new or novel; it is probably as old a procedure as any surgical practice associated with the domestication of animals. In some regions the spaying of the female pig, for the improvement of her meat, is as common a procedure as the castration of the male pig, and spaying is often practiced in the females of the bovine tribes among the beef herds, for the same reason of improving the meat. Now, in spaying a beef animal only one result is obtained, while in spaying a dairy animal two very desirable improvements are the result. In the first case, improvement of the meat in the beef animal is the only result; in the other case, that of the dairy cow, the quality of the milk is improved and many of the diseases and disturbing affections resulting from oestrum, pregnancy, and parturition are totally eliminated from the dairy. These latter disturbances have as much, if not more, to do with the production of positively bad milk as any single group of disturbing conditions in the dairy.

No one disputes the deleterious effects of colostrum from the cow when used as infant food. On dairy farms, as ordinarily conducted, abortions are very common, and often epidemic, and when these abortions occur the entire product of the dairy becomes colostrum. Cases of pelvic

cellulitis occur, septic absorption is common from placental retentions, and an amount of unhealthfulness prevails, while the quantity of milk produced is not very materially lessened. No one can dispute that under these circumstances the quality of the milk is very much lowered. This occurrence is not a very rare one, but comparatively common according to my experience and the reports of the dairy journals. The elimination of this trouble alone would quite if not more than compensate for the trouble of spaying every dairy animal.

Milk fever is a common affection of the dairy, and the phenomenal milkers are more prone to it than the less abundant milkers. This febrile condition must necessarily affect the milk perniciously, and as it only follows parturition, of course would be eliminated when parturition ceased to be one of the phenomena of the dairy. The occurrence of ovulation in the dairy has a decidedly deteriorating effect on the milk supply. I have myself, from numerous experiments, ascertained that in this condition a cow secretes milk that is intensely acid and emits a very disagreeable odor if heated in a test tube. The high-bred dairy cow is an excessively nervous animal, and during heat becomes frantic, and in the field with a herd, one bulling cow will often produce a

condition of excitement among her companions which distinctly and palpably affects the whole milk product of the entire dairy. If there were no ovaries in the herd, this disturbing condition would never occur.

Mammary abscess and mammitis, when not due to traumatism, are, in the great majority of cases, a complication of the parturient state. It often occurs in these conditions that the milk is mixed with blood and pus. Of course, neither of these materials would have much of a deleterious effect on a healthy stomach, but when we take into consideration the febrile state of the animal thus affected, and the excessive nervous disturbance resulting from the pain caused by the milker, this variety of milk is absolutely poisonous. A case of acute diarrhoea caused by this variety of milk, I reported some years ago in *The Medical Record*, under the title of "Acute Milk Poisoning."

Sore tits in various forms are common in the ordinary dairy, and occur usually in the first five or six weeks following parturition; these cracks and fissures, that become ulcers from the constant irritation of the milker, frequently contaminate the milk with a virus that must necessarily be productive of disturbances injurious to the infant that gets milk from cows thus affected.

Cow-pox, a disease which has attracted the attention of the entire civilized world, almost invariably commences in the cow soon after parturition, when it breaks out in a dairy due to the fact that there are cracks and fissures resulting from the excessive activity and consequent engorgement that takes place in the first few weeks after calving. Cow-pox is an acquired disease from the horse; it is pretty conclusively settled that horse-pox, a mild disease in the equines, is conveyed to the cow by the milker who had handled the horse, and thus inoculated the cow's dugs if these latter are excoriated, by the virus adhering to his hands. Cow-pox in the cow becomes an exceedingly loathsome disease, and is characterized very often by phagedenic ulcers, which are constantly irritated and excoriated by the milker, whose hands also become the seat of vesico-pustules. The following passage I quote from Crookshanks' book on "Vaccination," in his chapter devoted to cow-pox: "I hope it [vaccination] will be turned by enlightened men towards another perhaps of as nearly as great consequence [prevention of small-pox], namely, the prevention of the original malady in the animals themselves. Those who had witnessed it and only reflected upon the excessive filth and nastiness which must accordingly mix

with the milk in an infected dairy of cows, and the corrupt and unsalubrious state of their produce in consequence, will surely join me in the sentiment." Of course, other conditions besides mere spaying, which only incidentally makes the cow less susceptible, because the tits are less likely to be cracked and excoriated — which is necessary to receive the inoculation — are necessary to avoid this disease entirely in the dairy. It should be an inexorable rule that no one who is employed in attending on horses, should be allowed among dairy cattle. It cannot be doubted when one knows the degree of carelessness that prevails in many dairies that some of the simple throat affections of infancy and childhood are complicated and rendered grave by milk from cows with cow-pox, or other sore or aggravated conditions of the dugs that pollute the milk. We must all remember the interesting discussion in England on the so-called "Hendon cow disease," which was alleged by good authorities to have been the cause of an outbreak of scarlet fever. After reading all the literature available on the subject, and from practical experience, I conclude that the milk in question was contaminated either by cow-pox or ulcerated tits, because it is a well-settled fact that other sores besides those of cow-pox will cause

sores to arise on the hands of the milkers, and it requires no stretch of imagination to see that a virus like this, if conveyed to an irritated or morbid throat, would increase the existing disturbance. This of course seems plausible, but it is only a surmise.

Thus it can be seen, that by separating from the dairy entirely the breeding, very many of the common and constantly occurring disturbing conditions that perniciously affect the milk may be entirely eliminated, and the milk otherwise vastly improved. This is not surmise, but is in fact a demonstrated truth. I have in my own dairy several spayed cows, whose milk is used for infant food, and I have been obliged during the past summer to send milk directly into dairy communities so far from me that the milk cost the receiver seventy-five cents a quart. Communications from these people express surprise at the beneficial results of the milk I send them, being themselves right in the midst of dairy cattle and everything, to their observation, betokening health. Many of them imagine that I prepare the milk in some way. I only introduce this bit of personal experience, in order to reiterate that the milk is only pure normal secretion from animals that are removed from the danger accompanying these conditions.

The operation of spaying is a very simple one. I cast the cow on her right side, administer chloroform, produce complete anaesthesia; observing all the recent antiseptic precautions, I make an opening on the left flank, sufficiently large to admit my arm, which I introduce, reaching up into the pelvis till I find one of the ovaries. This I grasp with the hand and having previously serrated my thumb-nail with a file, I saw and scratch the attached end of the ovary till I separate it thus from its attachments. I drop this out of the abdominal cavity without entirely removing my arm and search for the other one, with which I proceed in the same manner. I withdraw my arm, and with a very fine catgut ligature I bring together the peritoneum; with a coarser catgut I unite the muscular structure; with a still coarser ligature I unite the hide, leaving between the hide and the muscular substance in the lower part of the wound a pledget of oakum for drainage; then I cover the entire wound with a large quantity of oakum, which is kept in position by means of adhesive plaster passed several times round the abdomen, and all left in position for ten days, when the plaster, oakum and drain are all removed and a little iodoform sprinkled on the drainage outlet. There is usually a rise of temperature of one or two degrees, that subsides

after the first twenty-four hours. The secretion of milk is noticeably decreased for the first two or three days, when it gradually increases, and at the end of ten days has reached its normal flow. We make no use whatever of the milk for two weeks following the operation, and not then if the site of the drainage is still discharging. I have in my herd one cow spayed four years ago, the first one on which I operated; she is giving as much milk to-day, if not a little more (about ten quarts) than she was before the operation. She never has been sick a day and is very quiet, never excited from any cause, in good condition of nourishment and promises to remain a useful animal for years to come. This same description applies to all my spayed animals. There is hardly a cow in my herd among the animals not yet spayed that I have not been obliged to throw away the milk of for days at a time, owing to injuries, indisposition or like causes; but among the spayed animals, I have not known of one being injured by the horns of their fellows, the most common source of injury among dairy cattle, because they are so quiet and keep by themselves that they are not subjected to the ferocity of their companions; they are never excited during the heat of other members of the herd. I am thoroughly convinced

that the coming dairy cow will be a spayed animal, and when she gains popular favor, then, undoubtedly, one of the most common and constant sources of disturbance in the milk supply will be removed.

Thus, then, it can be seen that by a careful and judicious system of breeding outside the dairy, and by surgical interference within, the proper type of dairy animal can be established. But unless this animal receive proper food and rational care, the improvements in her breeding and other conditions will count for less than they otherwise would. It is apparently one of the strange phases of human perversity that the animal that supplies the human race with the highest type of food—milk—should receive the least care and attention in regard to her food. Visit any dairy farm and you will find the horse-stable clean, the animals well and dryly bedded, curried daily, and fed with the best hay and oats. No refuse for these animals. But the cow you will usually find in a dirty stable, scant bedding, receiving no attention by the way of currying, and if there is any kind of refuse to be bought in the neighborhood, this is deemed good cow feed, whether it comes from the breweries, distillery, glucose or starch factory; and, in fact, all the refuse from the preparations of grain is classed as

good cow food. She is pastured usually on land that cannot be tilled, and the exception is when the cow receives any sort of rational care. The cow is entitled to the best food that is procurable, and unless she gets it we have no right to expect good milk from her, no matter what her other conditions may be. She deserves the whole grain; in corn she should not receive only the refuse that is left in starch and meal mills, but the entire result of the grist; and the same with oats, hulls and screenings are not good enough to produce good milk. About the common sorts of refuse used I will say nothing, because we all know that they are improper. For the life of me I cannot understand why some judicial legislative action is not directed against their use. I have in my possession a series of remonstrances stringing along for forty years, urging the necessity of stopping the use of brewery grains and distillery slops, but all in vain. I can understand, of course, why a good deal of this system prevails; the dairyman has been ground down too low in the price he receives for his product. He cannot possibly buy prime food for his cows, and he is compelled to pasture them and bestow as little attention as possible to their care. It would require more than double the price he gets now to feed his cows in the stable always,

when they are milking, summer and winter; it is only by this method that a cow can have her food judiciously selected. The cow is a strange animal; I do not know whether it is natural or comes from her breeding, but she will always drink the dirtiest water she can find; if there happens to be a putrefying carcass or dirty bones about the pasture she will sniff about them and chew the bones, and when the pastures are dry there is no poisonous or noxious weed that she will not eat. I repeat that I hold it as one of the prime requisites for good milk that the cow should always be fed in the stable with proper food. Of course this does not necessitate the cow being locked up all the time; she can be turned out the greater part of the day, and, in the hot weather, at night, if necessary, but not where she can get dirty water or be in the presence of filth of any kind, or browse on noxious weeds.

Thus, avoiding the oft-repeated tales of the calamitous diseases that are communicated or supposed to be communicated from the cow to the human race, I have confined my argument to the simple elementary necessities for a better dairy. But I am pretty well convinced from my experience that there is little to be hoped for from legislative action or public opinion, because

it seems to be regarded as a dangerous thing for legislative bodies to interfere with established commercial institutions, and the public trust in their lawmakers and sanitary authorities. If New York, with her wealthy, liberal and intelligent population, would organize a dairy scheme establishing the reforms I have indicated, the problem would soon settle itself, because it makes little difference what the price of good milk is if anywhere within reason. A supply of good healthy milk will surely crowd out the floods of bad milk that are now being poured into the city for the nourishment alike of infant and adult.

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STERILIZED MILK.*

Up to this, the bacterial age, the application of heat in the preparation of food was simply to improve its digestibility, or to meet the requirements of advanced civilization by improving its appearance, odor, or taste. Before man reached the age when fire was in use, putrefaction was the agent allowed to improve the digestibility of his meat-food. After the discovery and use of fire, it was found that it was not necessary to await the process of putrefaction to make food palatable and easy of digestion, but that fire would also improve its digestibility and increase its palatability, and that, too, in a more rapid manner. Now, with the prevailing idea that all diseases are due to a germ, another function of heat is to apply it to food in order to kill the germs that exist everywhere, and thus to avoid the imaginary or real pathogenic influences of bacteria. Enthusiasm in science is dangerous, and the present devotion to the germ phase of disease can

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not be classified as other than enthusiasm, and the prevailing enthusiastic warfare against all germs, leading as it does to sterilization of food, may be dangerous. Perfect sterilization as applied to food means complete death, and whether absolutely dead food is the best for infant nutrition may well be questioned.

The adult civilized human being has no natural food. All his nutritive material has been improved, and some of it almost generated *de novo*, by cultivation, selection, combination, etc. All wild animals have their natural food, and the young of all mammiferous creation are provided by Nature with a natural food. Among the animals where the female can not supply the natural nutriment the duty devolves on the male. But man, with his inherited idea of artificial food, imagines that the human young can be nourished by artificial preparations; the statistics, however, relating to artificially fed infants show how poorly the plan works. The natural food for the human young comes from the female breasts; this is a living, vitalized food; certainly we know that this food can be procured from the breasts of females who have not recently or at any time passed through the parturient state. We likewise know that the male is provided with mammary glands which will secrete this natural food for the young.

Thus it will be seen that Nature has abundant resources to supply vitalized food for the young, and it would seem, from all the plain teaching of Dame Nature, that the prime, necessary quality of food for the young is *vitality*. Contrary to this is the enthusiastic endeavor of the antibacteriologist to thoroughly devitalize all the food prepared for the baby. In the present state of society it seems inevitably necessary to endeavor to pass some of the young through babyhood by the use of artificial foods. Of all the artificial foods easily procured and abundantly supplied, the milk of the dairy cow is universally admitted to be the best. Unfortunately, however, the cow is a delicate animal, subject to many diseases that affect the milk perniciously, and her keeper is careless, often allowing the milk to become contaminated from many sources. The proper sterilization of cows' milk, when used for infant food, without doubt eliminates or neutralizes many of these disturbing influences, and the work of Dr. Soxhlet, Dr. Caillé, and others, has been, without doubt, of great value during the present condition of the dairies and the milk supplied to large cities.

But the apparent satisfaction that has taken possession of many at the idea of sterilization as having solved the problem of infant feeding, may

possibly delay the absolutely necessary reform that is required in the dairy itself. Cows that are perfectly healthy, receiving proper food and care, supply a milk, which, if properly guarded, retains much of its vitality for several hours, and is absolutely the best artificial nourishment for the human young. Sterilizing milk obtained under these conditions robs it undoubtedly of much of its nutritive value. Dr. Randnitz, of Prague, in Hoppe-Seyler's *Journal for Physiological Chemistry*, shows that much less nitrogenous material is absorbed from milk that has been boiled than from the same milk when fresh. He shows that 9.4 per cent. of nitrogenous material was retained in store by growing animals fed on fresh milk, and only 5.7 per cent. was assimilated by the same class of animals fed on boiled milk. It is a common observation that calves fed on fresh milk have what is apparently a normal yellow liver, which makes a very tasty human food, while those fed on the artificial foods of the dairy—boiled skimmed milk, hay-tea, and so forth—have a liver very dark in color, tough, and not at all tasty like the normal tender liver of young life. How much the vitality of the food has to do with this condition of the liver can only be inferred, but it does seem that one of the absolute requirements of perfect nutrition is that some ar-

ticle of diet must be fresh—that is, must retain its vitality—or, in other words, be not absolutely dead. Scurvy is one of the diseases which results from a devitalized diet—that is, one which excludes fresh living vegetable or animal matter. Now, what vitality is, it is almost impossible in the present state of our knowledge to define. With the animals we regard consciousness as one of the phenomena of vitality; but the absence of consciousness does not indicate death of the tissues. Vitality in vegetables is the principle that allows them to grow and reproduce; a vegetable would be absolutely dead when it will not grow under proper and favorable conditions. The egg of the hen, which is by common consent classified as a perfect food, because under proper conditions it builds up a perfect organized, and living body, if sterilized can by no possibility reproduce a living chick. Many articles of food, undergoing decomposition by reason of the living germs they contain, possess more or less of the vital principle which, in this case, of course, belongs to the germ. All around us vital processes are taking place in bodies which we call dead, and when human beings are placed in a position that precludes them from the possibility of obtaining some articles of diet not dead, they suffer from scorbutus, and when suffering from

this disease the ingestion of food, whether it be animal or vegetable, that still retains some vitality, causes the morbid conditions to subside. In artic regions, when men are deprived of fresh vegetables, they eat their meat raw. The general impression derived from medical text-books is that fresh vegetables are necessary for the cure of scurvy, but both Hall and Kane aver that the fresh raw meat is just as efficacious. Fresh cooked meat is not in any sense an antiscorbutic. We have many accounts of soldiers suffering from scurvy where fresh cooked meat has been a regular article of diet, and all the antiscorbutics (with one exception—lime juice) are nutritive materials that are not sterilized—or, in other words, that retain some degree of vitality. It is not necessary that a child should absolutely suffer from scurvy to indicate that its food is improper. There are undoubtedly a certain number of pathological conditions that are compatible with life, but the ability to resist disease and enjoy life is, beyond doubt, lessened by some conditions of nutrition, and, as the proper and natural nourishment of the young is a product from living tissues, itself undoubtedly containing some vital principle, it follows that children, as well as adults, require some form of food not devitalized by heat, or preservatives. The heat necessary for

the sterilization of milk, as practiced at present, undoubtedly lowers its nutritive value in other ways than by depriving it of whatever vitality it may have been possessed of. The soluble albumen is made insoluble, and many of the salts held in solution are precipitated, and thus become also insoluble; but of course, the lowering of the nutritive value of a food is far preferable when the sterilizing process eliminates or neutralizes absolutely poisonous principles or materials, and if it were beyond the reach of the powers that be, to improve the milk supplied for infant feeding, we would all favor the present mode of sterilization, even while fully aware that the food is not perfect.

But it is within the lines of human possibility to improve the dairy and thereby render the milk more nutritious and free from those disturbing elements which render sterilization necessary.

SCORBUTUS IN CHILDREN.*

The question of scurvy in infancy is, I think, one of the phases of children's diseases that has been lost sight of very largely in the study of Pediatrics. There is no doubt but that the disease exists in infancy to a greater extent than we are aware, or would infer from medical literature. There can be little doubt, when your attention is called to the fact, but that you will agree that many of the cases reported as rickets and marasmus, should be classified as scorbutus. Dr. Northup, of New York, read a paper on scorbutus, last September, in Washington, before the Pediatrics Society, and I think much good will come from this paper, which was a very interesting and instructive one. By simply calling the attention of pediatricians to the fact that such a disease does occur in infancy, and that it is characterized by very near the same pathological phenomena as is the disease in adult life. Now as this affection in the adult is well recognized, and the cause pretty well understood, I think it would not be

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amiss for me to call your attention to some of the conditions in adult life that stand in a causative relation to the development of scurvy, and then we can see how prone to the affection, the artificially fed infant of to-day must be. Every living creature on the earth or in the water thereof subsists on matter that was once alive, and all food with the exception of a few condiments, has been living, growing matter at one time. I think it can be safely affirmed that man is the only animal who not only kills his food, but makes it absolutely dead and sterile before he consumes it for his nourishment.

The old adage, "That God sends the food, but the Devil sends the cook," means more than has been credited to the saying. It has always been supposed that the unpalatable preparation of food was the devilish cook's work, but I believe the cook whom the Devil had sent to mislead us is the chemist with his retort and his balances, with his reagents and his surmises; he has led us to believe that God has failed to do His work properly by uniting the nutritive materials in a living form, and possessed with a vitality that the chemist knows nothing about. He has taken up a deal too much room, and made things altogether too complicated. The chemist would have us believe that man needs for his nourish-

ment only so much nitrogenized and so much non-nitrogenized matter, and that the material with which the Creator has united these, and the vitality with which He has endowed it, is totally unnecessary. According to the advanced idea of the chemist, a little jar of Liebig's extract of beef is far better than ten pounds of meat in the form we find it in nature. Milk that has been skimmed, dried and powdered, and mixed with a little cocoa butter, is far better than fresh milk from the laboratory of nature as the Great Giver has allowed us to procure it. I remember seeing it stated in some standard work, that when the chemist had reached his goal, armies would be able to carry in a small vial all the material that was needed for their support for several days, instead of the weighty load of bread and meat which they are now obliged to lug.

I tell you, gentlemen, the chemist has tried to be too smart, and we have been duped by him in many instances. Every living creature requires for his proper nourishment some raw living food. Every young living creature needs living food. The mammalia all take it direct from the living fountain, and young feathered tribes are supplied by their parents with living creatures for food. Even the embryonic fishes consume the living animalcule, and man seems to be the only one of

God's creatures who thinks he knows better. The artificially fed infant gets his food from the knowing chemist, or must, according to the prevailing fashion, have all the life sterilized out of it, if he gets any, as nature supplies it, without the intervention of the chemist. I am positive that there is more in organism, and the vitality that holds it together, than is dreamed of in our advanced chemical knowledge.

We know that the sea-faring man, the soldier, the peasant of a famine-stricken district, are all subject to scurvy when they are deprived of fresh living food and any growing vegetable, animal matter or other material not dead, will cure the disease. Milk retains its anti-scorbutic qualities for a few hours, so does meat after the animal is subjected to what we call killing. I suppose the muscular response to electric excitability will indicate the point at which meat retains its vitality after the animal has been butchered, and I think it is a well-known fact that vitality is the anti-scorbutic quality of a food. Now, if the absence of this quality for any given time from the nutritive material of an individual, produces such dire results as scurvy, it must follow that this principle is a necessary condition for the proper nourishment, and the chemists' idea that proximate principles being the only

necessity for nutriment, must be fallacy. Of course, neither the medical man nor the chemist knows what vitality is; we cannot weigh it, neither can we measure it, but it is with us everywhere, and by reason of its possession, we ourselves live and move and have our being, and every article of food we consume was gathered together, and formed into nutritive food for us by the living and growing quality of vitality. Is it unreasonable to suppose, then, that we can get from this quality some sort of force that is necessary for our well-being, and are we not depriving ourselves of some absolute necessity when we eliminate every vestige of vitality from our daily bread? Since I have been possessed with this idea, I have observed several cases of simple dyspepsia recover completely by the use of live raw food. A few months ago a patient came to me complaining of violent attacks of vertigo, and temporary blindness. He had been losing flesh and strength for several months. I examined his urine and found it to contain 15 per cent. of albumen. He was directed to take nothing but living raw food. That is, milk not over four hours' old, eggs laid but a few hours, raw oysters, raw clams, lettuce and other greens with no dressing, meat within a few hours after it was killed, eaten raw; apples, oranges and other raw

fruits. No medicine, except three drops of the tincture of nux vomica in water before meals as a mild tonic. At the end of fifty days the albumen had entirely disappeared. He had but few attacks of vertigo after he had the exclusive diet, and the attacks of temporary blindness never returned, and now, after five months, he is in a better state of physical health than he had been before for years.

Now this one case proves very little, but it at least indicates that the diet must have had some influence in the man's recovery. I do not affirm that albuminaria always arises from the same cause, neither do I think any will affirm that defective nutrition is not one of the prominent etiological factors in Bright's disease, and if I am right in my deductions, one of the defects in our materia alimenteria is the absence of vitality, and if this is true regarding the adult, how much more must it be so with the luckless infant deprived of the normal living fountain which nature designed for its proper nutrition. I am firmly convinced that not only scorbutus, and other serious affections, arises from the absence of living food in the infant, but many of the weakly non-resisting babes succumb to disease, or live with more or less suffering, because of the absence of vitalized food.

One of the defects with the finite mind is its limit to be able only to harbor one idea at a time, and so when one man discovers a truth he straightway imagines that he has solved all the mysteries of the science relating to the subject to which the discovered truth relates. I am willing to acknowledge that the vitality of a food is not its only requirement, but I am thoroughly convinced that it is one of the very important necessities to perfect nutrition. There can be little doubt that many children live who have been so improperly nourished (although fat) that life is more or less of a burden. A great deal of this may be due to their progenitors, their surroundings, and many other conditions, but some suffer by reason of improper food, and the method of its administration.

The French nation have as an executive officer in their scheme of government a medical health officer. He has lately discovered that the death rate in infants is so alarmingly large that there is great danger of depeopling the nation; therefore, he has issued an edict forbidding the use of the long-tube nursing bottle in feeding infants, and I suppose he imagines that by this wise (?) law he will repeople France. If the death rate could only be lowered by so simple an edict, our occupation would be gone, but we know that there

are many other conditions, graver, more important and serious than simply the form of a nursing bottle. There are very many things for us to find out before we know it all, but one fact I feel sure of, that the constant use of dead food with an infant is wrong. There is no greater field, too, for the pediatrician, than the study of infant feeding. We must exclude from our counsels, absolutely, the patent baby food manufacturer, and study how we can get a full supply of fresh, raw, living food to the unlucky infant who has to submit to an artificial diet, and then, from the knowledge we are now in possession of, we will know that we are guarding the young, at least, from the danger of scurvy and, perhaps, greater evils.

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SOME OF THE DANGERS SURROUNDING THE DAIRY.*

If the dairy is suggested to the every-day urban citizen, his imagination immediately conjures up the fair and buxom milkmaid, the foaming pail, the breath of the sweet-smelling kine, luscious cream for his oatmeal and strawberries, golden pats of butter, and bountiful, innocent sweetness, milk and honey. It may be owing to this sentimental idea of the dairy that so many take kindly to raw milk, while having at the same time an abhorrence at even the thought of eating raw meat from the same animal; when, actually, the danger of contagion, disease, and the ingestion of impurities are far greater from the milk than the meat. Few people, I believe, realize the menace which lies in the milk-supply of cities. Milk which is dangerous, and perhaps deadly poisonous, appears just as innocent, innocuous, and deliciously nourishing as the fluid that is so in truth.

In many of the dairies supplying milk for food

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nearly everything is either totally wrong or not quite right enough to produce a wholesome product. It is well known that the dairy cow is subject to numerous grave diseases, and many of her maladies are, we know, the same as those which afflict the human race, and it is also an established fact that any disease in the cow affects her milk perniciously. Every one who observes current literature on the subject knows that there are several articles of absolutely refuse material which are used as food for the dairy cow, while she is expected to give in return one of the highest types of food for human use. The cow is necessarily a delicate creature. What condition may be imagined, except actual disease, that is more opposed to robustness, vigor, and hardihood to withstand the shock of cruelty, bad food, and dirty surroundings than maternity and lactation? The cow, while giving us milk almost constantly, at the same time sustains a fetus; and so it is only reasonable to affirm that the dairy cow must receive solicitous attention, gentle treatment, and absolute cleanliness in her surroundings and feeding, if it is expected that she will supply milk fit for human food. It was long ago discovered that what affects the mother affects the nursling, sometimes even so far as to cause the death of the latter.

Unfortunately, it is the exception to find a dairy in which the cows are treated kindly and fed or housed in a cleanly manner. At the present time health authorities appear to recognize nothing but tuberculosis as the sum total of all the disease and danger contained in the improperly managed dairy. The sources of possible contamination which surround the milk after it is drawn from the cow are many and serious on the majority of dairy-farms as they are conducted at the present time, and it is this part of the hygiene of the dairy to which I particularly wish to call attention now, because this branch of the subject receives everywhere less attention than it deserves, and I believe that when we are able to exclude the diseases which arise from milk-contamination in the dairy, outside the cow, we will be better able to trace some of the epidemics which find origin in the animal herself. Until all the dangers of the dairy are recognized many of the more grave and menacing ills cannot be remedied.

It must be remembered, in considering milk, that there is no other article of food just like it. There is no food, fluid or solid, which presents so many favorable conditions for the absorption of the tangible material of disease and for its preservation and multiplication, and in no other instance

is a medium found for the conveyance of infection by which so much harm can be accomplished in such a very short time. Of course, a certain degree of heat will disinfect milk, but even a high temperature will not eliminate the toxins already contained therein.

We are constantly searching for a specific remedy for scarlet fever and other often fatal diseases of childhood, while frequently permitting the bacterial cause of these diseases to be fed to our children in their milk. Many of the diseases of infancy may be rendered much less frequent or even altogether eradicated by proper attention to the hygiene of the dairy, and I believe that the achievement of success in this line is being delayed by the futile efforts of well-meaning physicians, who imagine that they are correcting the evils of a bad milk-supply by modifying, pasteurizing, sterilizing, adding animal and chemical compounds, and by otherwise changing the character of the milk.

Around every dairy is a multitude of dangers —dangers, unfortunately, which are not always appreciated or avoided, and hence culminate in disaster. There are many other animals about the dairy besides the cow which menace the dairy product, often as seriously as a diseased cow herself. Horses, dogs, cats, rats, mice, and fowls

undoubtedly are often the direct means of infecting milk, and of thus passing contagion along to the human race.

Cats loll and purr around many dairies all day, and it is a very common thing to see a wheezy old cat lapping warm milk from a pail or other milk container. These animals are known to succumb to a throat trouble which appears identical with human diphtheria, and it is also known that they die from many tuberculous forms of disease. So it is not unreasonable to ascribe contagion to these animals when they are allowed the freedom of the dairy. Dogs prowl about the farm day and night, and very often depend upon the carcasses of dead animals for their living. Cows, horses, and pigs often die of septic and contagious diseases; the carcasses are hauled into the woods or fields, away from the house, and there left exposed as meat for the farmer's dogs. These dogs come back and lap the milk from the pail, lick the empty milk vessels which are never properly cleaned; and can there be doubt that the milk is thus infected? Where this danger exists in a dairy it is practically unlimited. Rats and mice infest the ordinary dairy; they get into the milk and the milk-vessels. These animals also have their diseases, and, therefore, the element of danger and disease from these pests must be ac-

knowledged. The poultry around the farm are sometimes very numerous, and not always healthy. The diseases to which they are subject are many, and, owing to their high, normal body temperature (108° Fahr.), there is no other animal which so readily becomes tuberculous or which dies so quickly from this disease. On some dairy farms the hens are everywhere, in the cow stable, in the milk-house, in the dwelling-house, and even in the milk-pails. The dairyman, as a rule, has a family of children who are often attacked with the grave diseases of childhood. The milking vessels are frequently washed in the house, and not unusually there is a close connection between the house and the dairy, and sometimes the living-house is, itself, used as a dairy-house. It requires no argument to point out the dangers here; in fact, numerous epidemics have been traced to such a source.

Those who milk the cows are not always free from disease; often we see the milker with hands that are cracked or sore. One of the dirtiest habits which exist in many dairies is that of wetting the cow's teats to lubricate them, to make the milking process easier to the milker. This custom, not rare, unfortunately, is the most common nasty habit permitted in many dairies. If it

were not for the good that is sure to follow the agitation of these matters I should hesitate to record that I have myself seen milkers spit upon their hands to wet the teats before they began milking, and then, when there was a certain quantity of milk in the pail, dip their dirty hands into it, and keep the teats dripping wet during the whole process of milking. Cow's teats should not be wetted in any manner, especially in winter, even to wash off dirt if it is already there. This should be removed with a brush or a dry towel. Wetting of the teats very often leads to chapping, and chapping to cracks, and these cracks often become running sores from the constant irritation of the milking process.

In these days of bottled milk the danger of spreading contagion is vastly increased. Bottles which go into rooms where children are suffering from any of the contagious diseases must be a source of danger if they are not subsequently sterilized. Quite recently I had occasion to visit a man who did a large bottled-milk business in New York city. The milk came in wagons from the upper part of Westchester county, and he had a horse-stable half way between his source of supply and New York. Here his horses were changed. All the milk came to this stable in cans, and the empty bottles came back here from

New York to be washed. He had two wooden troughs in this stable, and a stove with a large kettle to heat water, and the bottles were washed here in luke-warm water with sal soda, rinsed with cold water, and then filled from the cans.

I think, if some of us followed these bottles around and had seen where some had been, we would want them pretty well steamed and sterilized before we drank milk from them. It is often a source of wonderment to me why we do not have more direct and palpable evidence of trouble arising from just this state of affairs. Of course, there are unfortunate results from this sort of carelessness; but how much or how little we are not always able to say. We ought to be able to prevent it by insisting that all milk containers be sterilized with steam under pressure after each usage.

When the dangerous elements are recognized and eliminated from the dairy, then it only requires that the cows be healthy, properly fed and cared for, in order that we may have milk fit to drink and to feed to the baby, without the intervention of the chemist or any of the prevailing laboratory methods, which at the best are only questionable makeshifts.

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